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Molded Products and Their Manufacture

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Molds for molded plastic products must be designed and constructed to give high production and close accuracy of the finished parts

In the manufacture of molded plastic products, the design and construction of molds is a most important consideration. High production, and a higher degree of precision in the shapes and dimensions of the parts produced, are both demanded by the molder. Present-day molds are larger than those of a few years back, because of the trend toward multiple-cavity types, are held to much closer dimensions, and are often far more complicated than was the case before the molded plastics industry had reached its present extensive stage of development. The principles of mold construction, however, in general are much the same.

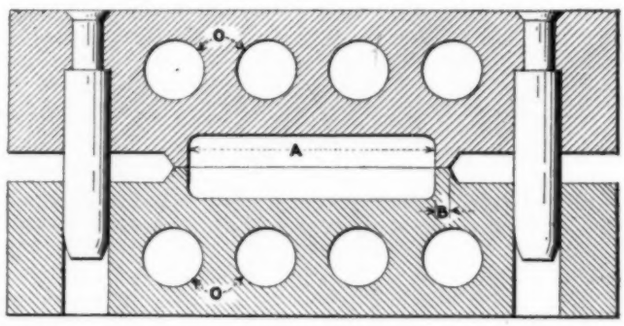


Fig. 2—A common type of mold is the flash mold, so-called because excess material flows out in a fin or flash at the joint

With the exception of bronze molds used in blowing hollow articles of pyroxylin, and cast-iron or type-metal molds, used for rubber, molds for plastics are generally made of hardened steel. Occasionally, bronze or soft steel is used for experimental work, but these metals find no use whatever in production molding. Tool steel is perhaps best suited to the purpose, but pack-hardened machine steel finds equal favor, and an even softer grade is used in molds produced by the hobbing method, to be mentioned later.

Whatever the material of the mold, hardening is essential for wearing qualities. The finishing operations, consisting of grinding and polishing, are equally essential in producing molded articles which will have the required smoothness of finish, without hand buffing.

Molds may be classified broadly as hand molds and semi-automatic molds, depending upon whether they are handled by the operator, or are fastened in the molding press. Hand molds are limited in size by the weight which can be conveniently handled by the operator, while semi-automatic molds are limited only by the size of press. Hand molds have the disadvantage of being only indirectly heated, by surface contact with the press

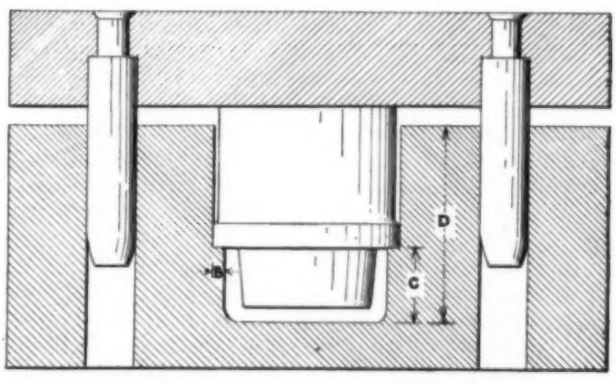


Fig. 3—In molding bulk powdered materials a positive type of telescoping mold is often used

The second of a series of articles. The third article, to appear in an early issue, will deal with plant equipment.

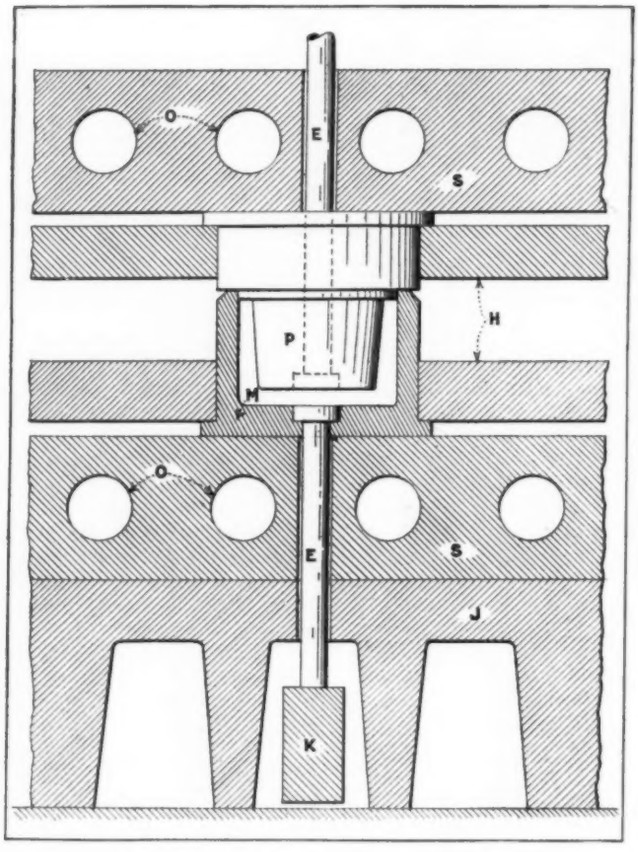


Fig. 4—A semi-positive type of mold, combining features of the flash and positive types, and with the actual mold impressions made separate from the plate, is used where the material is preformed into tablets

platens, while the semi-automatic variety, although sometimes heated the same way, are frequently ported, so that steam is introduced into the metal of the mold itself, resulting in much more rapid operation. Either kind of mold may be made in "single impression," or "multiple cavity," form, and in either case the type may be "flash," "positive," "semi-positive," or "sub-cavity."

In Fig. 2 is illustrated a "flash" type of mold. An excess of material must be loaded into it to insure complete filling. In molding, the excess compound overflows, or "flashes" out from between the cut-off edges. This is a simple and relatively inexpensive type, suitable where a shallow mold may be used. Because of the slight depth, the heating and chilling is quite effective, even in a hand mold. In a single-impression mold of this type, the mold impression is usually cut directly in the material of the mold, which is generally rectangular in shape. Dowel-pins must be provided to guide the parts of the mold accurately together. These are fastened in one plate to prevent pulling out, and, to insure proper engagement, must project at least as far as the most projecting part of the mold section to which they are attached. While this height is commonly exceeded in the flash-type mold, it is very important to have it fulfill the above requirements in some of the other types.

In figuring the pressure necessary for the molding operation, it is essential to add the area of the cut-off edge to the projected area of the mold cavity. This total area, times the molding pressure per square inch, gives the tonnage requirement per impression. In determining the width of cut-off edge, the choice lies between two evils. In the case of a wide cut-off edge the back-pressure on the plastic material is sufficient to give a fairly dense product, but the resulting fins are thick, and will require more time for removal. If a very narrow edge is used the fins are almost negligible, but the product is not dense. As a result, the width of cut-off edge is determined by practice and, referring to Fig. 2, dimension B is usually made $\frac{3}{64}$ in., seldom varying more than $\frac{1}{64}$ in. either way. Occasionally the cut-off surface is designed to sustain the total load, without material in the mold. In this case the compressive stress should not exceed 10,000 lb. per sq.in., or the edges may be deformed.

In using this type of mold, with a compound in powdered form, it is necessary to preform the material into "tablets" of the required size. This is a fairly inexpensive operation, and greatly facilitates loading of the mold. Since the tablets are preformed at four to six tons per sq.in., they will sustain the load of the press, when in the mold, preventing the final closing of the mold until the compound is sufficiently plastic. This type of mold is unsuitable for molding from bulk powdered material, as the material would be squeezed out upon applying pressure, leaving insufficient compound to fill the mold, after becoming plastic. The flash-type mold, having no sliding parts, is unusually well suited to large production, where long life of the mold is important.

In Fig. 3 a positive type of mold is shown, suitable for molding bulk powdered material. One part of the mold is made to telescope the other, without allowing escape of the molding material. Accurate weighing of the mold charge is very important for uniformity in density of the product, while a positive stop, in the nature of a "land" at B, insures uniform height C. The great depth of mold D required to accommodate the initial bulk of the material, makes these molds expensive to produce, and of course the added weight is very objectionable if a hand mold is contemplated, as the number of impressions per mold will be less than in a flash-type mold of the same weight. The mold depth D, of Fig. 3, is roughly two and one-half times the height C of the molded piece, although this ratio is not fixed, but depends considerably upon the material used as filler in the compound. Since the plunger requires enough clearance for a sliding fit, material is apt to extrude slightly, forming a thin film, which may make separation of the parts difficult. If the mold is of semi-automatic type, the pull-back cylinder of the press will be sufficient to overcome the adhesion, but a hand mold may require stripping in a separate press.

Occasionally a type of mold called semi-positive is used, in which features of Figs. 2 and 3 are combined, and which is illustrated in Fig. 4. In this type the plunger P is relatively short, and not so tightly fitted as in the positive mold. The back pressure created by the material flowing past the plunger and over the cut-off edge is sufficient to give a dense product, with

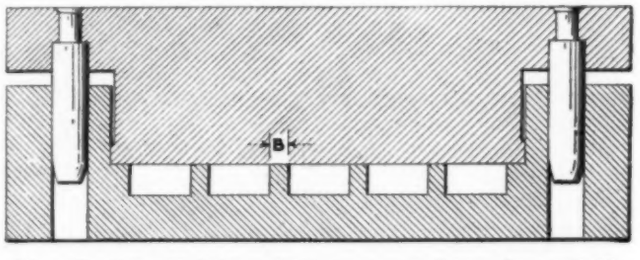


Fig. 5—For molding shallow work from loose bulk material, multiple molds of sub-cavity type offer economies in weighing and loading the charge

no thicker fin than in a properly designed flash mold. Owing to the short plunger, this mold is not suited to bulk materials, but is used with tablets.

Illustrated in Fig. 5 is a "sub-cavity" mold. These are made as multiple-cavity, or "gang," molds and are suitable for molding shallow work from loose bulk material. Their particular value lies in the simplicity of loading with a single weighted charge which, upon becoming plastic, will fill all of the various cavities. Since this is a flash mold, in principle, the total land-area *B* must not exceed the area of the cut-off on a corresponding flash mold; otherwise, the pieces will be joined by an objectionably heavy fin.

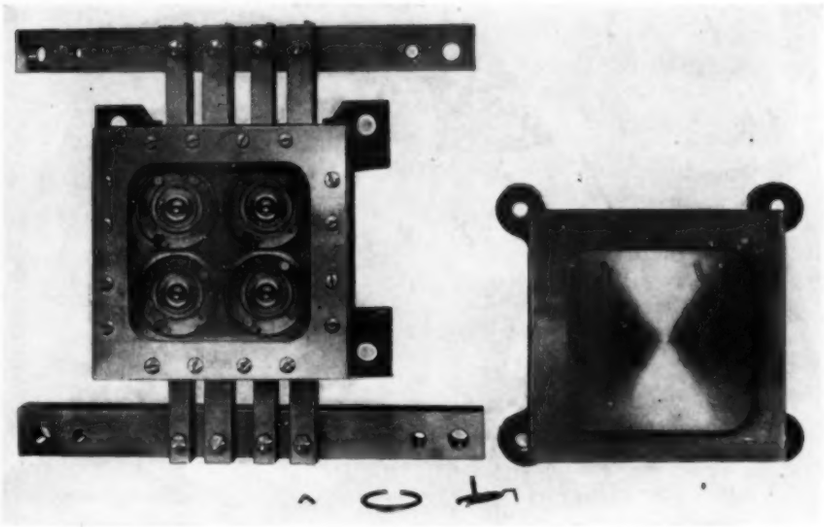
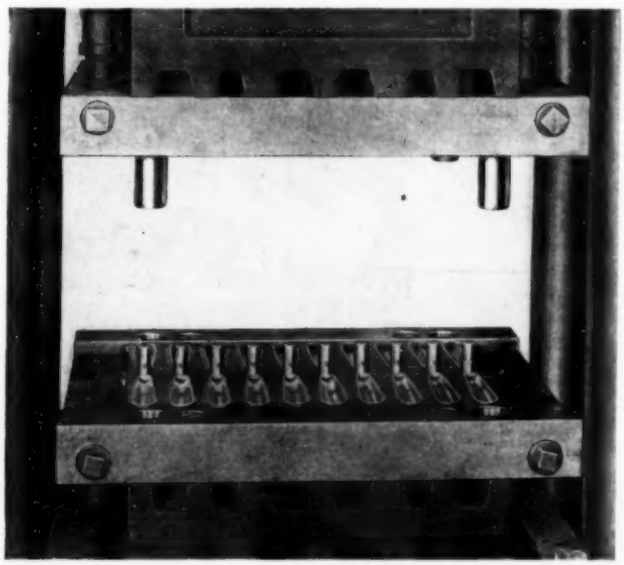


Fig. 7—In this four-impression, sub-cavity, direct-heated mold, shown with its ejector frame, a single charge fills all the impressions and there is therefore an economy in loading

In all of the foregoing discussion, it must be borne in mind that only the simplest illustrations have been used to show the type. In each case where a single cavity is shown, a mutliple-cavity mold is far more common. If the impression is such that it can be cut only by hand, then a multiple-cavity mold will be generally cut from a solid plate, for instance, an extension of the mold illustrated in Fig. 2. While this plan has the disadvantage that the spoiling of a single impression does not allow re-



All photographs are from The Burroughs Company

Fig. 6—Where molded products are made in large volume, multiple-cavity flash molds turn them out at low cost. This mold produces twenty handles at one operation

placement of the impression, this type of mold is easily adaptable to direct heating, by means of steam ports *O* through the mold body.

If, on the other hand, the impression is of a shape which can be made on a lathe, or produced by some duplicating process such as "hobbing," then the separate "forces" *P* and impressions *M*, as in Fig. 4, are best produced separately, and set into holding-down plates *H-H*, which are fastened to the steam plates *S* in contact with the mold-parts. Thus, individual impressions may be replaced, as necessity arises, and the holding-down plates may be used subsequently for other impressions. This mold is by nature indirectly heated by contact with the heated press platens, and while the area in contact is not so large as in the case of a mold cut from the solid, a gain is made in the smaller amount of metal to be heated. This style of mold, especially in the flash type, is the most used at the present time for resinous plastics.

It frequently happens that in spite of shrinkage in cooling, and draft on the sides of the mold, the finished pieces have a tendency to stick and cannot be removed from the mold with the fingers. To make ejection positive, ejector pins are provided. Fig. 4 illustrates the use of ejector pins *E-E*. The heating plates must be designed to allow the pins to pass through without interfering with the ports. Corresponding holes must also be provided in the grid *J* which rests upon the press platen *T*. The pins themselves are shouldered to set flush with the inner face of the mold during the molding operation. As the platen completes the opening stroke, the ejector pins *E* are moved by the ejector bar *K*, which strikes stops before the end of the stroke. On a large mold these separate ejector bars *E* are carried by an ejector frame.

If ejector pins are to be used both top and bottom, a special ejector cylinder may be employed for the stationary half of the mold, or rods from the moving platen may operate the ejector frame for the opposite half of the mold. In either case the ram, even when returning of its own weight, cannot be depended upon for the force required, and a pull-back cylinder must be used to insure return of ram and ejection of pieces. Occasionally the ejector pins are made of different lengths, ejecting the pieces at different times and requiring less total ejecting force. A slight draft on the sides of an otherwise straight-sided mold, will facilitate ejection, especially on deep molds. This draft may be as little as 0.003 in. per in. and still be quite effective.

For uniform heating, it is very important that the halves of the mold be designed to have the same weight of metal in them; otherwise the molded product will have a tendency to warp. If one half of the mold is unavoidably lighter than the other, its contact area with the heating plate may be proportionately reduced, if it is an indirectly heated mold, or a throttle valve may be

employed to equalize the heating time, by admitting less steam to the faster-heating plate. A thin coating of paraffin on the mold-surface is the simplest and most reliable guide to show whether or not the plates heat and cool uniformly.

In designing molds for molding to fine limits, which is becoming common practice, it is very important to know the shrinkage allowance. This not only varies greatly between different plastics, but has a wide variation in any one resinous plastic, depending upon the filler used in the compound. The shrinkage allowance can generally be given by the manufacturer of the plastic for any of the ordinary materials, and will usually be determined for a customer in the case of special compounds. In addition to allowing for shrinkage of the material, it is also necessary to know the characteristics of the particular steel used in the mold in order to leave enough metal for grinding and polishing after hardening. After hardening, an impression in one steel may be appreciably larger than before, while a similar impression in a different steel may shrink under the same treatment.

While inserts of various materials are frequently imbedded into an article during the molding operation, the tendency is away from this practice as far as practical. Threads are formed directly in articles, whenever possible, rather than molding a threaded metal insert into the plastic. This method saves the time required by the operator to set the inserts in place in the mold. It is equally true that a subsequent machining operation may prove cheaper than accomplishing the same purpose by use of pins or loose pieces in the mold.

In Fig. 6 is shown a multiple-cavity flash mold for molding twenty small handles at one time. A small hole was required in one end of each handle, and advantage was taken of this requirement for ejection of pieces. The pin forming the hole runs horizontally through the larger, vertical ejector pin, servicing each pair of cavities, and the work is automatically stripped, with the raising of the ten ejector pins.

A small, direct-heated, sub-cavity mold of four impressions, with ejector frame is illustrated in Fig. 7. It should be noted that a single charge is used to fill all the impressions. Inserts for the article are shown outside of the mold.

In Fig. 8 is shown a positive mold, indirectly heated, for the production of the electrical distributor in the upper part of the illustration. At the left of the finished article are shown the inserts, which are molded in. The mold, made in three main parts, has several loose pieces and a total of twelve parts, illustrating the complication involved in an apparently simple article.

Hobbing the Molds

In the foregoing, mention was made of producing molds by hobbing, rather than by the other alternative, the machining method. Hobbing consists essentially of forcing a hardened steel "hob" or "force," of the shape of the finished piece, into a steel blank, to form a mold impression. At the outset, this is a duplicating method of producing molds, in contrast with the machining method, and is much in favor for multiple-cavity molds generally. It is especially desirable in classes of work where molded products are being substituted for metal parts, and interchangeability is a requirement. This demand for interchangeability has been the chief factor in developing hobbing to its present state, from the elementary method used for many years in the jewelry trade. Incidental to the duplicating advantage, it has been found that the cost of producing dies by this method is often much less than by machining, and that some all-but-impossible machining jobs may be performed by the most simple sort of hobbing operation.

The hob is made of high-carbon tool steel, formed with the required accuracy, and finished with a fine polish. Since the hob is a "force" or a "positive," it is generally much simpler to produce than a single corresponding impression by the machining method, and the polishing of all impressions is reduced to polishing of the hob alone. The importance of polish cannot be overstressed. It frequently happens that the difference between time spent in imparting a high lustre to the hob, and that in giving merely a mediocre finish, may be lost several times over in the subsequently required polishing of individual impressions. As an example of the degree of duplication obtained, and the importance of finish, a pencil mark on a polished hob will be reproduced in the impression. A speck of lint will also leave a mark. To prepare the hob for use, after machining and polishing, it is given extreme hardness by quenching in iced brine. The temper may be slightly drawn by immersion in boiling water.

Next in order in producing the mold is the preparation of the required number of blanks. These are

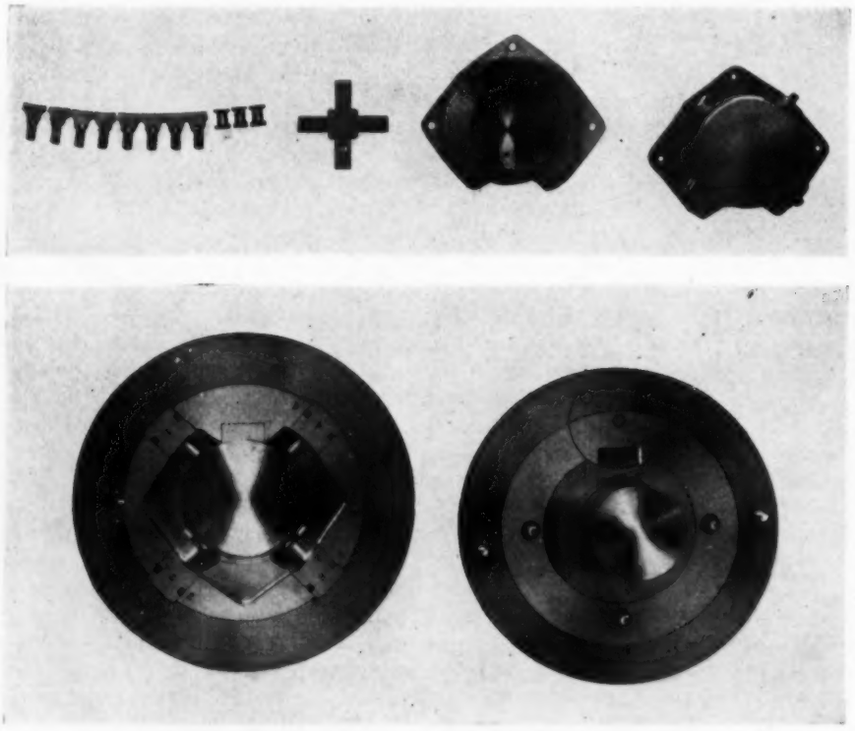


Fig. 8—The electrical distributor, shown at the top, with inserts at the left, is produced in a mold made of twelve pieces, assembled in three main parts

roughly the size of the finished impression, enough material being allowed for external machining to fit the plates into which the individual impressions may be inserted. The blanks are prepared from a very low carbon steel, or wrought iron. These metals have good flowing qualities, not found in the high carbon steels, and while, in some cases, even tool steel may be hobbed, it is not satisfactory for deep hobbing. The blanks are softened as much as possible by annealing, and the face to receive the hob is polished. For a simple hobbing operation no further preparation is necessary, but in particular cases of deep, or otherwise difficult, work the blank may be roughed out to the approximate shape of the hob. It may be merely concaved on the face, or even relieved on the back.

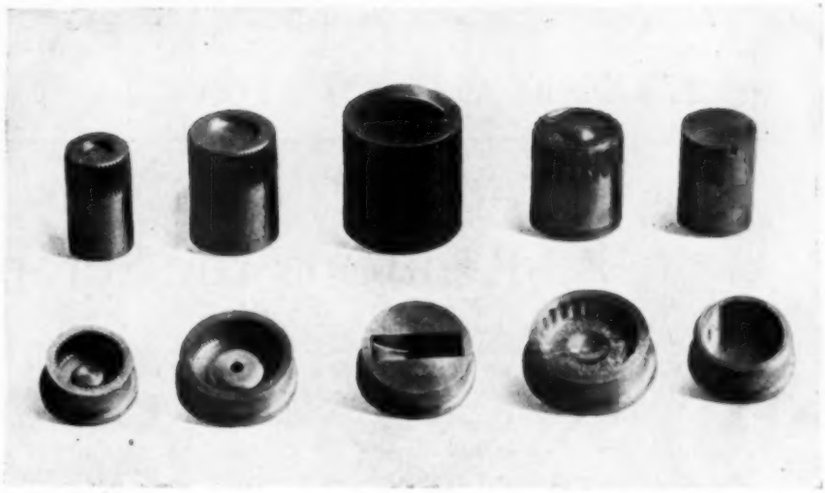


Fig. 9—In the upper row are typical hobs for making steel dies, or molds, and in the lower row are the dies produced from them

Thus prepared for a simple hobbing operation, the hob is forced into the blank, in a press of extremely heavy tonnage, designed for the work. The operator watching the pressure gage notes the rise in pressure as the hob enters the work. A constant pressure, after the initial entering of the hob, indicates that the work is progressing satisfactorily, and the operation is continued until the required depth is reached. In hobbing deep work in this way, it is found that the die blank tends to harden under the pressure of the hob, and requires intermediate annealing operations before the hob may be sunk to the required depth. Impressions produced by this method usually show ridges or waves, indicating the several separate "squeezes," and are usually thus found objectionable. Apart from this, any unconfined blank hobbed by the above method has a tendency to spread laterally, and while for many classes of work this is not serious, it cannot be allowed on precise work.

A method originated and developed by The Burroughs Company offers a great improvement over the foregoing procedure. In this method, the die blank is confined in a heavy chase ring of machine steel, having a hardened tool-steel bushing at the center. The die blank is placed in this hole, with the hob against its upper face, and backed up by a hardened steel plug against the lower face, this latter also contained in the chase ring. The pressure applied flows the metal of the blank up and around the hob, while no lateral displacement is possible.

In regard to the pressures required, the old "hundred tons per square inch" rule is rather misleading, since each different steel requires a different pressure. An unconfined blank may be hobbed with as little as 50 tons per sq.in., while the same blank, confined, may require 100 tons. Tool steel requires as much as 200 tons.

In any case, the impression, after hobbing, requires some external finishing, and is then pack-hardened to a depth of about $\frac{1}{32}$ in., and may even be tempered, depending upon its use. A very slight polishing is required, to remove effects of the heat treatment.

Fig. 9 illustrates several hobs and the dies produced from them. The first two illustrate the simplicity of producing knurling. At best, this would be a two-piece die if produced by machining, and even then the beveled edge shown would make it especially hard to make. The central figure, showing the circular tongue terminating in vertical sides, is a good example of a very simple type of hob saving several difficult machining operations. The next figure shows how one type of lettering is produced. Where raised or relief lettering is not essential, an engraving machine may be employed to advantage. The last figure shows a simple type of hob, saving several machining operations and a good deal of handwork.

Value of a Shop Library—*Discussion*

By W. Roland Needham
Stafford, England

THE interesting note by Joseph Viggiano on page 277, Vol. 70, of the *American Machinist*, on the above subject calls to mind the excellent example set by a large engineering firm on the northeast coast of England. The drawing office of this company has a large technical library, furnished by the firm, to which all draftsmen and designers have ready access. The library is very representative, being well provided with books on mechanics, mathematics, and on both the practice and the theory of engineering and electrical subjects. Many of these volumes would prove too expensive for the private purse of most members of the staff. In so far as the men make adequate use of the intensely practical literature put at their disposal, they themselves benefit and they share with their employers the fruits of the added insight and knowledge gained.

Every works should most certainly have its technical magazine club. In many ways this can prove a more useful service than even the best library as such. Highly technical books soon become out-of-date in certain of their contents, especially such as describe machinery. The responsible technical journals, however, remain *topical* and are necessarily up-to-date in description and explanation of new machinery and processes. These journals should be available for all interested. The custom which would keep the technical literature as a preserve for departmental chiefs is, to say the least, a short-sighted policy. The work done by assistants is most important work—many assistants of today will be tomorrow's chiefs, and these men will serve all the better and more usefully by being up-to-date. Assistants well instructed and well equipped are a priceless asset to any company. One means to that end is the suitable provision of current technical literature.

Reducing the Scrap Heap

IT WAS lunch hour at the Business Men's Club and there were several at the "Iron Table," so-called because many of the metal manufacturers ate together there. Bill Holland was with them—and they were discussing the ever present problem of spoiled work.

"There's nothing more exasperating," said Sam Walker, "than to see good castings, on which several hours of good labor has been expended, going to the scrap heap because somebody drilled a hole too big, or turned a piece too small."

"You're right, Sam," said Ned Harper. "It gets my dander up every time I see it. There's a lot of dividends go into the scrap heap, boys. And there ought to be some way of preventing most of it. Perhaps Holland here has a real solution."

"If he had," spoke up Bill, "he'd have more money coming his way than you birds will ever see. But he hasn't—and he doesn't know anyone who has."

"But don't some shops have definite plans for reducing spoilage, Holland? It was Hary Harper this time.

"Most shops try to prevent spoiled work, of course, Harry," said Holland. "There are about as many methods as there are shops."

"Tell us some of them," piped up Harper.

"Methods vary from bonuses to fines," said Holland. "But the fine proposition doesn't have much of a chance these days. Bonuses, based on the percentage of good work, seem to help in some shops. Some think it pays to apply this 'good work' bonus to a group, so that every member of the gang is on his toes to prevent any one of them reducing his bonus."

"But we pay for good work and we ought to get it," said Sam Walker.

"Why waste time talking about the millenium, Sam? As long as all of us make a mistake once in awhile, it's foolish to expect perfection from the man in the shop. When we are crowding men for more producton, we mustn't expect hundred-per-centers. They don't grow—not even around this table.

"Some shops, however, are reducing spoiled work considerably by studying just why it happens. They find that mistakes in drawings, in tools and in instructions are responsible for a lot of spoiled work.

"Other shops put all the spoiled work of a department in a pile where everyone can see it. Some even go so far as to tag each piece with its value, including material and labor to date. In shops where bonuses are paid, this is a constant reminder of how much is being lost because of mistakes."

"One of my friends in the west," broke in another of the group, "says that if he could cut out all errors in his shop, he could pay higher wages, run only four days a week and make more money than he does now. It sounded impossible to me, but perhaps he's right."

"How do the big automobile shops work it, Mr. Holland? They must watch spoiled work pretty closely, don't they?"

"They vary, as your shops do. They have spoiled work, too. But they have men watching tools and machines very carefully. Before a run starts, the first piece is carefully checked to be sure the set-up is right, and frequent check-ups are made to catch tool wear, or movement in adjustment, as soon as possible."

"One of my men attended a meeting the other day and brought back the statement that over eighty per cent of mistakes were because the man had never been properly taught to do the job. The claim was that practically every mistake was made because some fundamental instruction had been omitted at some time during the training period of the workman."

"I've heard that too," said Holland, "and there probably is something to it. I've hesitated mentioning it because I know most of you think you haven't time for training men. I was going to spring it before we broke up. And, as long as Sam has mentioned it I'll suggest you think it over. You might ask yourselves a few questions, such as: How much can I afford to pay for training to prevent half my present spoilage? What kind of training do I want? Who can do it? You may not find the questions as easy to answer as you think."

EXECUTIVE FORUM

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

Discussion

Rules—and When to Break Them

In our plant, employing more than 10,000 people, a great many rules are set up which generally must be observed, but at the same time are flexible enough to allow for minor infractions. It is not our policy to allow every book or magazine agent, who calls at the door, to roam the factory at will, for this means interruption of production and encourages idleness among the workmen. We have, therefore, devised a method to handle cases of this kind.

For instance, if an agent for magazines, books, engineering courses, clothes, or any proposition, wishes to secure customers among our employees, he receives a pass at the factory gate, which permits him to make contact with one of our industrial personnel executives. This man, in turn, makes a survey of the benefits which the employees may derive from the purchase. If the product and its price are approved, the salesman is allowed to set up his display in our large restaurant, where, during noon hour, he may come in contact with the majority of our employees. He is given the space necessary to display his goods, and from what I have observed many sales are made through this method.

—Fred Aug. Schmidt, *Industrial Engineer.*

Day Work or Piecework?

The chief reason that day work tends to show less production than piecework is that, in most cases, under day work the worker does his own planning, uses whatever tools are handy, suits himself as to speeds and feeds, guesses at the accuracy and finish, and sets his own pace. Unless the management has planned all these factors, it has failed in its function. When they are predetermined, and the day-wage-rate averages that with piecework, under the requisite supervision an equal, or even better, result is possible.

While in charge of the manufacture of airplane cameras in England I introduced a system, in connection with day work, that fostered co-operation and produced good results. The plan was patterned after a suggestion system. When a worker developed a better method of doing his job, he was given the privilege of working his "patent" for six months. During that period he was paid a "royalty" on any increase in production brought about by his improvement. At the termination of the six months the method was subject to incorporation in the regular production planning, and thus became general practice.

When investigation showed conclusively that the improvement was the result of individual effort and could not be attained by other workers, the reward remained in force as long as the extra output was maintained. This method stimulated production, and as good results were secured with day work as could have been brought about under piecework, if not better. —James G. Turton.

Is the Shop the "Goat"?

The first place to attack the problem of cost is in the design of the product manufactured. Very often changes can be made which do not effect the efficiency or stability of the product, but simplify its production and eliminate expensive manufacturing operations. After the design has been simplified, manufacturing equipment and methods can be carefully studied and improved wherever possible. The purchase of new machinery and tools to reduce manufacturing costs should be postponed until it is certain that the present manufacturing equipment is being used to its maximum efficiency, and that the cost of the new equipment is warranted by the corresponding decrease in production expense.

While manufacturing costs are being reduced, sales and distribution costs should be likewise carefully studied to see where expenses can be cut. Sales costs, of course, cannot be reduced in the same way as manufacturing costs. The nature of the product manufactured and sold, and the market demand for it, will have far reaching effect on the amount of money that has to be spent for advertising and distribution.

In many cases it is possible, by increasing the amount spent on advertising, to create a larger demand for the product. Thus, by increasing the quantity manufactured, a corresponding reduction in manufacturing costs is effected. Large savings can be made in costs of distribution, but, until a careful study has been made of both selling and manufacturing departments, no one can say which department offers the greater opportunity to cut costs. —C. L. Anderson, *Methods Engineer Western Electric Company.*

It is hardly probable that costs can be cut in the sales department of the average manufacturing plant, in the ratio that they have been cut, in many instances, in the shops by the introduction of modern machinery and methods. It is also true that the average effort that has been made during the past five or ten years to reduce costs in sales departments have come far short of those made in manufacturing departments dur-

ing the same time. This condition indicates lack of co-operation.

Due to the fact that those of one department do not know the other fellow's troubles as well as their own, each department is inclined to think of the other as a necessary evil. Hence, the organization as a whole suffers.

Is there not a disposition to take a gambler's chance in sales departments, while production departments have to run the gauntlet through "Missourians?" I believe Bill Holland has the right slant on the situation.—JOHN MARK MAY.

Most executives of industrial organizations realize that sales activities absorb far too great a portion of the company's income. The more strenuous competition becomes, however, the more difficult it is to reduce this item. Railways are one of the exceptions to the general rule, perhaps the typewriter industry is among those affected the worst, while the machinery industry, in general, occupies a mid-position. A well-known make of pencil, retailing at 10 cents, involves an expenditure of 3.7 cents for materials, labor, insurance, depreciation, transportation and profits, while the remaining 6.3 cents is what the customer pays for having the article sold to him. The same relative costs prevail in many lines and indicate a real chance for economies in selling.

Production costs have been greatly reduced by studies and improvements in methods and equipment. Similar studies in the sales field will bring about far greater savings than further activities to reduce production costs can possibly do.

—H. JAMES, *England.*

Should a Buyer Specify Design or Results?

Some years ago I told a well-known machine-tool builder in Germany that I would not buy the best machine on earth unless it had a real lubrication system. I defend this point of view even more vigorously today. Occasionally, machine builders forget that their products are designed to be tools, and tools are intended to disburden the worker.

A few years back we bought a number of drill presses, of a design thoroughly modern at the time, but with sixteen oil cups each. The machines were well constructed, in general, but words fail to describe the lubrication troubles we experienced. The manufacturer gave us a fair amount of assistance, but the drill presses were never satisfactory machine tools from the standpoint of production.

Since that time we insist that suppliers promise results, and we make a careful investigation before purchasing equipment. Design is not important, results are everything. A well-conceived kinematic layout does not necessarily mean that a machine will meet the exacting demands of modern production.

—FRANZ BERMANN, *Austria.*

The "Can't-Be-Done" Man

Many years ago the writer saw a cartoon headed "The Right Punch." It depicted a husky lad punching the "t" out of the "can't" in the above title. Jim Baxter, selected by Frank Baker to hold a responsible position because of his former good service, evidently has that punch, and, as his ability is already proved, he will turn out to be a greater asset to his company than the big boss at present appreciates.

I know of a case where the appointment of a new works manager, with a view to carrying out considerable improvements in manufacturing processes, resulted in the dismissal of one or two old hands who held the opinion that they had "all the real ideas sewed up," and strenuously opposed new ones. The manager was of the "can-be-done" type and had his way, with results quite inexplicable to the remaining "elders." For, although by introducing new methods, re-routing machinery operations, modifying designs, and other changes, piecework times were considerably decreased, the men actually made higher wages in the end, the cost of the machines manufactured was much reduced, and the product was improved in quality. —C. NORMAN FLETCHER, *England.*

Day Work or Piecework?

A piecework or a bonus system appeals to the workers because they feel that extra effort on their part obtains immediate and tangible return. They are spared the uncertainty of waiting many months to know whether or not their work is to be rewarded by a raise in pay. The disadvantages are mostly those arising out of the fact that so-called fixed rates of pay are, in practice, subject to revision, which from the operator's point of view, is usually another name for cutting. Accordingly, workers are apt to hold back production deliberately in self defence. The result, however, is against the best interests of both employers and employees.

If, in the early stages of any type of work, it is impossible to fix permanent rates, that fact should be expressly stated, together with the reasons. It may be advisable to maintain tentative rates for a period as long as twelve months. Under this plan a fair trial can be made. Once the experimental stage has been passed, however, permanent rates should be agreed upon and set as soon as possible.

The Austin Motor Company's plan of wage payment has proved effective over a period of years. A standard rate is set, based on the average performance of an average worker. This output is set as the standard to be attained. Any increase over the standard is paid for according to the time saved. Output has increased most satisfactorily under this plan, and it has satisfied both company and workers.

—W. R. NEEDHAM, *England.*

Grinding Operations in Railroad Shops

By Fred H. Colvin
Editor, American Machinist

Internal grinding methods are used on a wide variety of parts, including the "honing" of cylinders and valve motion bushings

INTERNAL grinding in railroad shops, as mentioned before, has largely increased since the introduction of the radial valve gear on locomotives. Air pump and water pump cylinders, as well as fire door opening cylinders, are also being ground in many shops. Beginning with the older types of internal grinding machines, some of the more progressive shops are now using the latest machines, one of the Heald Size-matics being shown in Fig. 7. This has the sliding jaw collet chuck, and handles valve motion bushings rapidly and accurately. The bushing shown is first bored, leaving from 0.020 to 0.030 in. for grinding. The tolerance is 0.002 in. The time required for grinding varies somewhat with the sizes of the bushings, which run from $1\frac{1}{2}$ by $2\frac{1}{2}$ to 3 by $4\frac{3}{8}$ in., but this variation is not as much as some might suppose. The small bushing, for example, is ground at from 35 to 40 per hr. while with the largest size, the hourly average is from 25 to 30 per machine.

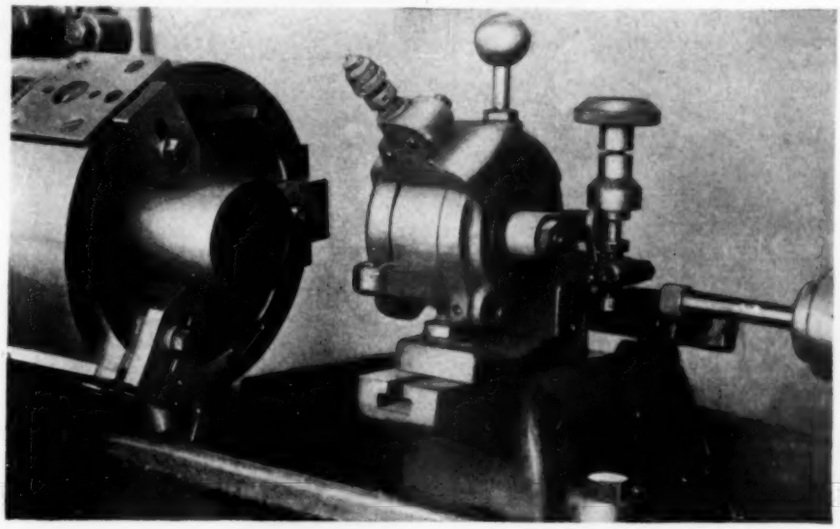


Fig. 7—Automatic, self-sizing grinding machine used by a large railroad in making valve motion bushings for replacement. These bushings are standardized and can be ground rapidly and accurately

Another use of the internal grinding machine is seen in Fig. 8, where an air brake triple valve is being reground. Fig. 9 shows how the valve is located by the pilot in the center, and held by the three fingers around the flange. The production on this machine is so high that it would probably stand idle most of the time in the average back shop. If this work is concentrated at a given point on a large railroad, it could be handled very effectively in this way. The hole is $3\frac{1}{2}$ in. in diam., $1\frac{1}{2}\frac{1}{2}$ in. long, and about 0.010 in. is left for finish, the tolerance being 0.002 in. The grinding time is one minute each.

Another type of internal grinding machine used in the railroad shop is the "planetary," in which the grinding wheel travels in a circle while revolving at its proper speed. Among the uses of machines of this type are the grinding of connecting rod ends to receive either floating or stationary bushings, as in Fig. 10. The work is fastened to a suitable support, as the angle plate, and the work table carries the work back and forth over the wheel. With such heavy work, and with the overhang shown, provision is made for supporting the outer end while the whole piece is moved back and fourth over the wheel.

In Fig. 11 is shown a machine of this type on the finish grinding of valve motion bushings after they are in place in the motion arm. Two other jobs for which this grinder is particularly adapted are shown in Figs. 12 and 13. There are steam reverse gear cylinders, the cylinder itself being ground in Fig. 12, and the guides for the crosshead in Fig. 13. These show how easily the parts can be located on the table, using a tram at the back end and blocks with adjustable screws to secure alignment of the cylinder. The planetary machines shown are known as the Micro grinders.

One of the more recent developments in finishing by means of abrasives is generally known as "honing," although it is a genuine grinding operation as now practiced in automobile and other production work. Railroad men who are not familiar with the new process are prone to confuse it with the old slow process of lapping, and to dismiss it as a refinement that has no place in the railroad shop. Nothing could be more erroneous, for honing, to use the generally accepted term, is a production operation that produces accurate holes in a remarkably short time. The success of this method in the automotive shop makes it necessary for the railroad shop man to become familiar with its possibilities with a view of using it on many railroad jobs.

Conclusion of the article.

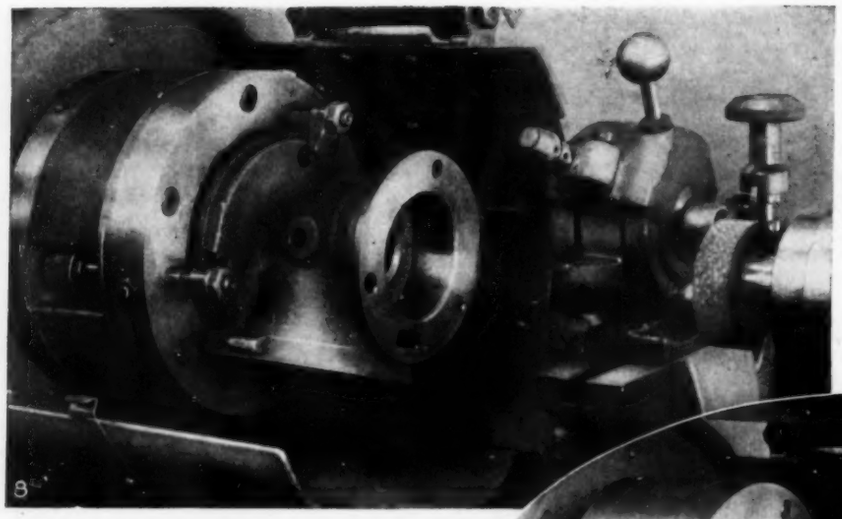


Fig. 8—Type of grinding machine used in grinding air brake triple valves where the quantity warrants a capacity of about one per minute. By concentrating all air brake work, a large railroad might utilize one of these machines

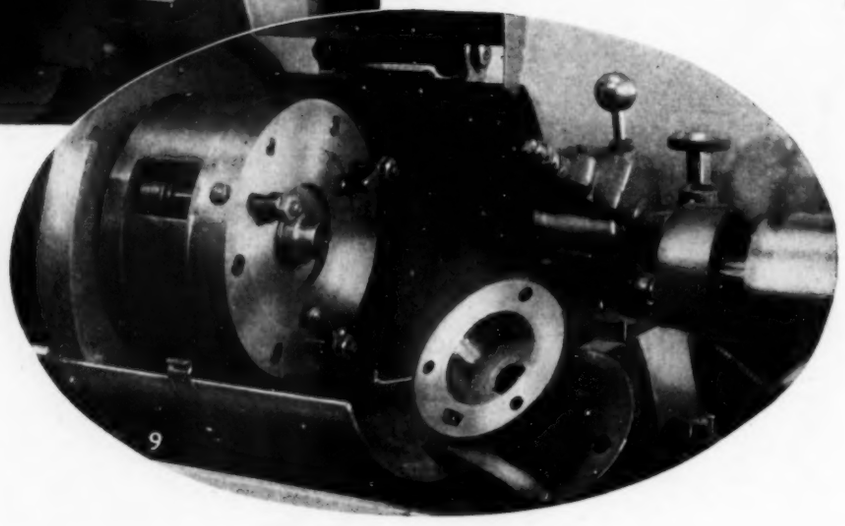


Fig. 9 — Details of the chuck used. Shows how the triple valve body is located over the central stud and held by the three, air-operated clamping fingers

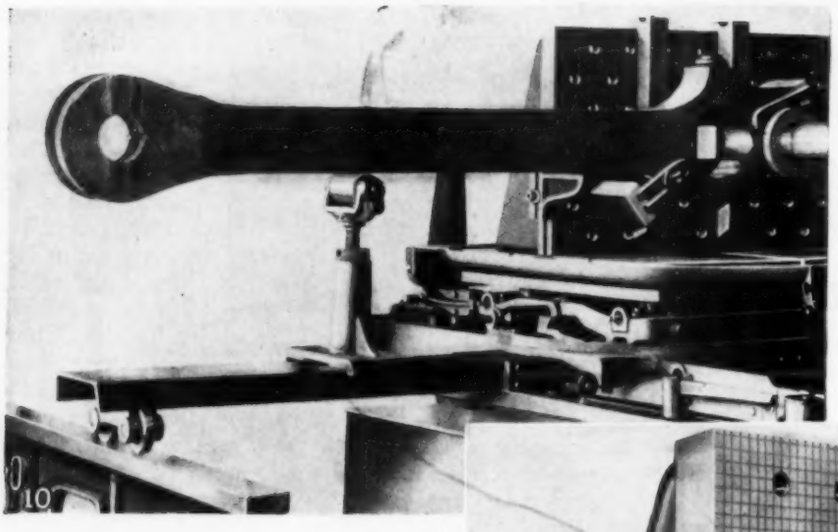


Fig. 10—Planetary type of grinding machine at work finishing the end of a connecting rod to receive its bushing. It shows how the unbalanced end of the rod is supported as the work moves over the wheel

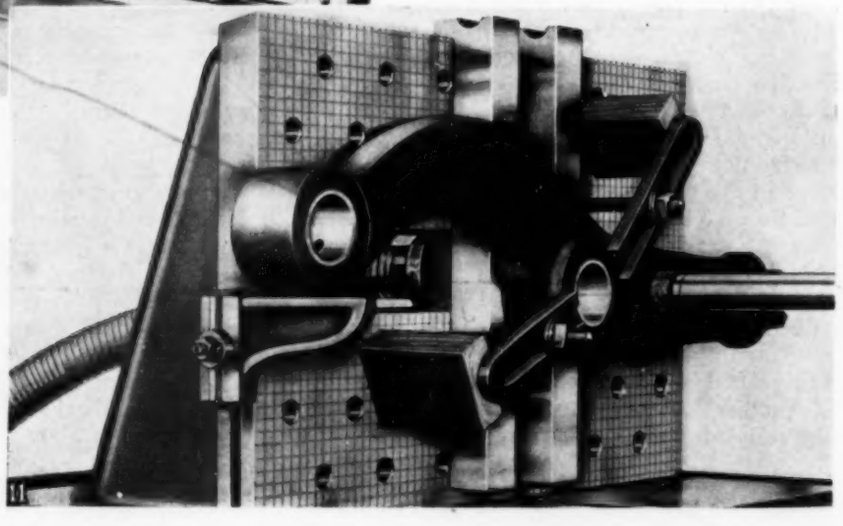
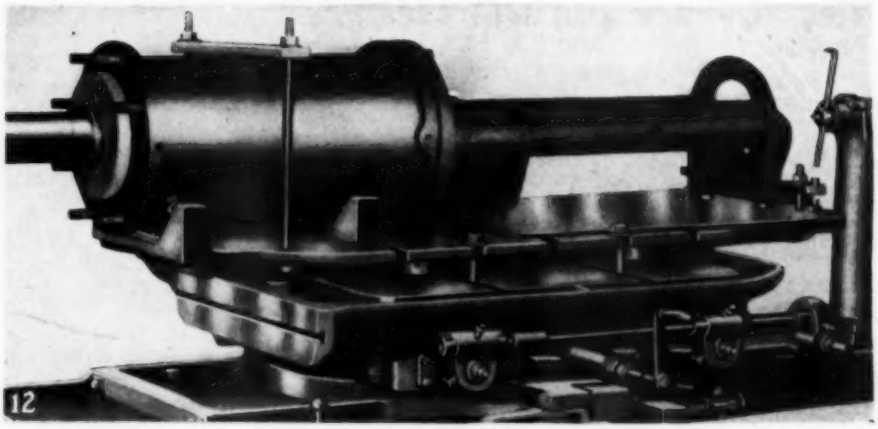


Fig. 11 — A similar machine finish grinding holes in valve motion bushings after they are pressed into place in the motion arm. Proper holding fixtures insure alignment of the holes

Fig. 12—Grinding the cylinder of the steam reverse gear now used on large locomotives. The plate on the table permits the casting to be readily located and clamped in position



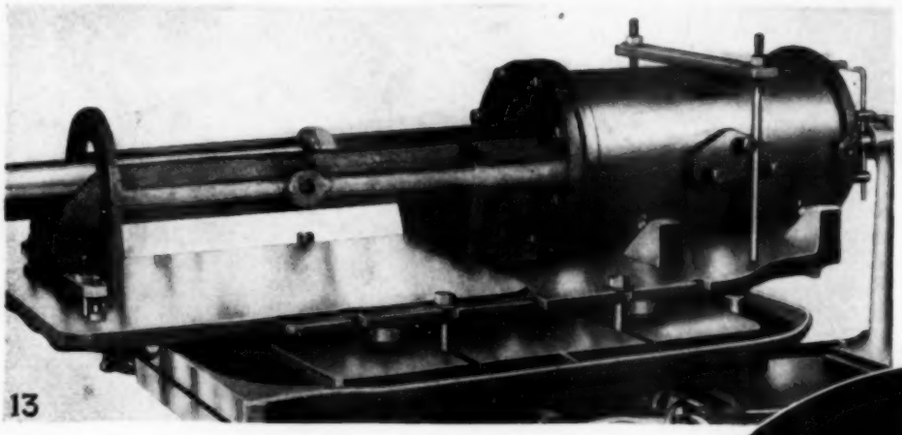


Fig. 13—Grinding the guides of the same reverse gear cylinder. This shows the plate reversed and the tram being used to align the end of the cylinder

Fig. 14—Finishing the bushings in a valve crosshead in a large railroad shop, using the new type grinding head, commonly known as a hone. These hones are now making their way into railroad shops

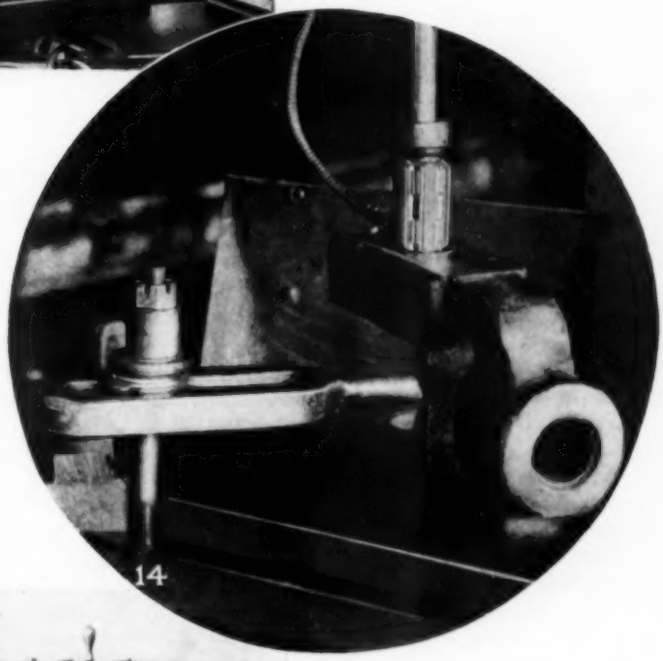
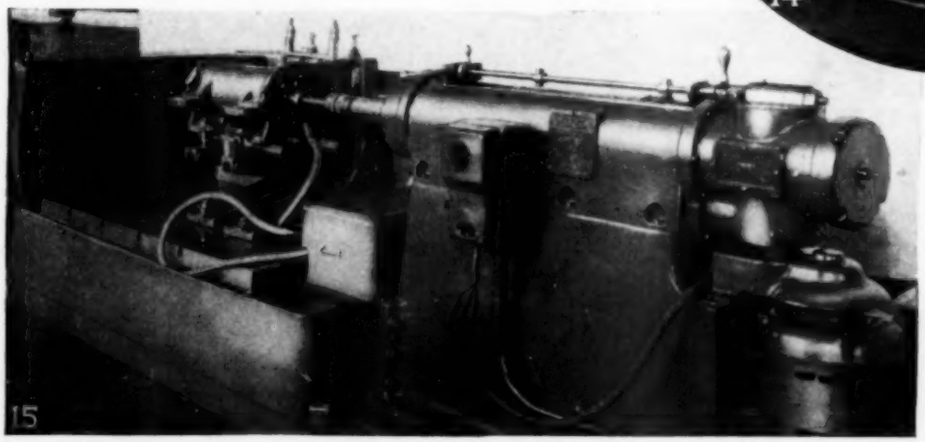


Fig. 15—Cylinder grinding machine using the expanding type of grinding head instead of a wheel. This method of grinding is common practice in the automobile field



A grinding job using this kind of a grinding head is shown in Fig. 14, finishing the bushings in a valve cross-head in the shop of a well-known railroad. As will be seen, these grinding heads, or hones, consist of a holder which carries six narrow blocks or "stones" of abrasives, of suitable grade for the work to be done. These heads permit the stones to move inward below the size of the hole, so as to be entered in the hole without touching it. When in place in the hole the stones are forced out to a definite diameter shown by a micrometer graduated collar. The head is then revolved and reciprocated, at the same time, back and forth through the hole under a stream of kerosene.

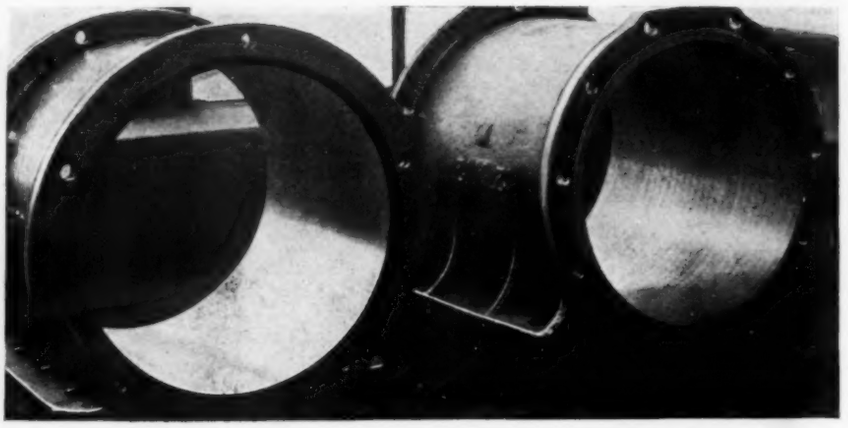


Fig. 16—Comparison of a cylinder in which uneven tool marks still show after years of service and a cylinder ground with one of the new type heads, in 13 minutes

The holes are $1\frac{3}{4}$ in. in diameter. Both holes are ground with a tandem grinding head, removing 0.010 in. from each bushing in 14 min., so that a 1.75-in. plug gage will pass through both holes, showing size and alignment.

A machine for finishing cylinders and other work within quite a wide range by this method is shown in Fig. 15, where a reversing gear cylinder is being finished in the same way. This is a 7-in. cylinder from which 0.015 in. of stock was removed in 9 min., the tolerance being only a half thousandth. The tank between the machine and the cylinder holds 35 gal. of kerosene, which is pumped into the cylinder through the hose shown. Such a machine can handle cylinders 55 in. long, and stroke the grinding head up to 27 in. to handle almost any railroad cylinder in general use.

Two other cylinder jobs are also of interest. Fig. 16 shows two 12-in. air pump cylinders. The one at the right has been practically worn out in service, and yet the tool marks are still very distinct, indicating that there was never a real good contact between the piston rings and the cylinder bore. The other cylinder is new, having just been ground by the newer method, in 13 min., during which 0.024 in. of metal was removed. An example like this should dispel the idea that honing is merely a polishing operation that is not at all necessary in railroad work. The Hutto grinding head is the type used on the work shown in the last three illustrations.

Give the Draftsman a Chance

By Karl Nixon

MUCH has been written, and properly so, upon the necessity and advantage of the draftsman cooperating with the shop. But, because the work of the draftsman restricts him very closely to his board, few realize the disadvantages he sometimes labors under because of this enforced aloofness. True, on production drawings released after proper experimental and development work in the shop, he should be accountable for any errors committed as a result of those drawings, but when it comes to development work, he often deserves more consideration and less condemnation that he gets commonly.

I know of an instance where a dimension line might possibly be construed as meaning more than one point. The right point was more obvious, and in order to use the wrong point the shop man had to modify two other dimensions. Yet, in solemn conclave on the spoiled work, the assembled executives decided that the draftsman was responsible, because he should have made it impossible of misinterpretation.

The supervising engineer often feels perfectly free to change his mind upon the type of design on development work, yet, if the drawings are not issued on time, the draftsman is held responsible. Again, a draftsman may complete a design, only to have it disapproved by the engineer, and told to try to design something better —but without being given specific instructions as to what type of development would be acceptable. Any new development design is capable of refinement after it has once been established—by any competent observer, including the draftsman. Yet, a group of engineers and shop executives will hold a conference over some detail point, and after deliberation, order a detail change in a highly authoritative manner. They often spend more aggregate time on such a detail decision than the draftsman was allowed to spend in designing the whole job.

An error in the drawing may be made to serve as an excuse for an extension on a shop job that is behind time, with the draftsman taking all the responsibility. The draftsman may suspect this, although he is seldom in a position to prove it, and many times accepts the situation rather than waste his time in alibi hunting.

Instances such as those cited are not to be construed as indicating that the draftsman is without fault, but rather as a plea to "give him a break." Speed is one of the essentials of a good draftsman today, particularly since design work is usually carried as overhead. Therefore, when his work on a new project is critically examined and criticized, he soon feels forced to spend an increased amount of time on his drawing in order to protect himself against any possibility of criticism, which may not be at all desirable when the new project is of a highly experimental nature. After all, originality and ideas are things which cannot be produced automatically, and when a draftsman succeeds, it should be borne in mind that he is quite human, and that he cannot work at his best if the only notice he gets is criticism and condemnation for any detail error he may make.

The Use and Abuse of *Carboloy*

By Emery G. Gilson
Research Laboratory, General Electric Company
Chief Engineer, Carboloy Company, Inc.

If the users of tungsten-carbide alloys will realize the importance of careful handling and grinding, much better results will be obtained with the tools

A STUDY of the development and use of cemented tungsten carbide, since its introduction into this country, shows conclusively that unless the tool is designed, and the application made, with a proper understanding of the characteristics and peculiarities of this material, full benefits from its use are not obtained. It has been amply demonstrated that the material has wonderful possibilities, and when properly applied and used will often give results almost unbelievable; but when not properly applied, or not properly used, failure can, and almost always does, result. Much has been said about the characteristics of tungsten-carbide alloys but let us again emphasize the more important ones. The material is very hard, ranking next to the diamond on the scale of absolute hardness. It has practically no ductility, therefore it is very brittle. Its heat conductivity and its thermal expansion are both low. Consideration of these characteristics indicates the material to be more nearly like glass than like a metal in respect to them. And as a matter of fact, this is so. Experience has shown that, if the conception can be conveyed that the material being used is similar to glass in these respects instead of like metal, and that it should be handled accordingly, much better results are obtained. This is particularly true when the tools go into the shop. It has been found that if the man using the material can get a rough picture of similarity to correspond with that outlined above, he handles it a great deal differently than he is in the habit of handling the ordinary steel tools. This difference does not entail any greater hardship upon the man nor cause any slowing up in his effectiveness, but simply means perhaps a little more attention to details in handling.

Tungsten carbide ranks close to the diamond in absolute hardness, but in ductility and thermal expansion is analogous to glass and must be handled accordingly. Toughness in the cutting edge of the tool is imparted by the technique of fabrication and through its cobalt content

There is still another characteristic, undefinable, but yet very important, in the application of cemented tungsten carbide to the industrial arts. The best term for this probably is toughness. As is well known, it is not possible to use straight tungsten carbide as a tool, on account of its brittleness. It is the addition of cobalt which gives it sufficient strength, or toughness, to be used as a cutting tool. Therefore, it is logical to believe that the toughness can be graduated by controlling the cobalt content. To a certain extent this is so, but it is far from being the controlling factor in this respect. Of much greater importance than the amount of cobalt present is the technique of making the material. This particular phase of it has been the subject of much research and development, and intensive work is still being carried on.

Owing to the nature of Carboloy, the best method of using it as a cutting tool has been found to be in the form of a small tip applied to the cutting edge. This tip may be fastened to the steel shank by brazing, welding, or simply by mechanical clamping. Copper brazing, done in an atmosphere of hydrogen, has proven to be the most satisfactory for general all round use up to the present time. Other methods, however, are being investigated, and experiments looking toward improvements are being carried on all the time and some very gratifying progress is being made along these lines. Mechanical clamping, wherever it can be used, is very satisfactory. But there are very definite restrictions that must be observed in this type of application, and these have so far prevented its very general use. The attachment of the cemented tungsten carbide tip to the steel shank is the weak point in this type of tool. The tip itself will work at higher temperatures than any method of attachment yet developed will stand.

In applying the tip to the steel shank, it must be remembered that Carboloy is quite brittle, therefore, it must be backed up against all cutting forces. The design should be such that the stresses from the cut will be transmitted through the Carboloy directly to the steel backing. If this is properly done, the alloy will easily stand the most severe loads that can be put upon the tool. For, while the metal will break rather easily under bending load (having approximately only half the strength of steel), it will stand high compression loads without harm. In fact, it probably has the highest compressive strength of any known metal. This means, of course, that the steel shank supporting the Carboloy tip must carry all the load of the cut. Therefore, a suitable steel for this purpose must be used. The steel must have stiffness and ability to withstand impact. It should also hold its strength well at elevated temperatures, have good heat conductivity and as low a coefficient of thermal expansion as possible. It is also an asset if the steel be capable of heat treating within the temperature range of the particular brazing operation used. If the steel will

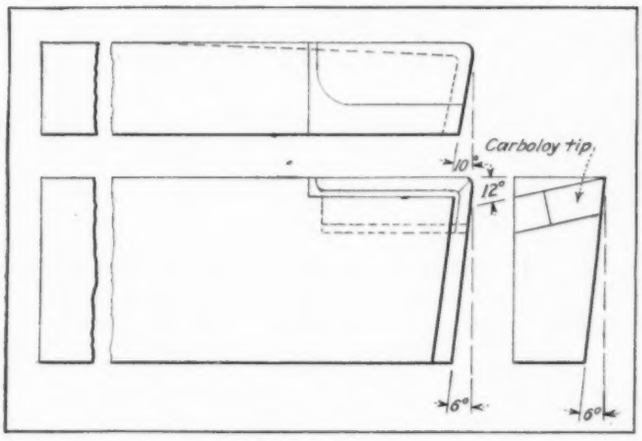


Fig. 1—Recommended clearance angles to be employed on Carboloy tools

air harden from the brazing temperature, it becomes all the more attractive for the purpose, for then it can be given a certain amount of heat treatment while brazing if necessary and the condition of the shank is somewhat under control.

All Carboloy tools should have the most rigid "set up" that it is possible to obtain. It is, therefore, advisable to use steel shanks larger than the tools ordinarily used for the same operation. This increase in the body of the tool tends to reduce the vibration at the cutting point. This refers more particularly to those vibrations of high frequency and low amplitude, which are not visible but are there just the same, and can be very detrimental to good performance and long life. The larger size also gives greater capacity for heat dissipation, giving a much greater conducting path from the cutting point and larger surface for radiating the heat. This also is very advantageous.

Experience has shown that, when using Carboloy tools, best results are obtained by departing somewhat from shapes and angles most commonly used. In general, the best type can only be determined by combining the knowledge already gained in applying Carboloy with a knowledge of the job and what is to be accomplished. As an example, while the ordinary round nose type of roughing tool gives very good satisfaction, it has been found that by modifying it somewhat, as shown in Fig. 1, much better results are obtained. The best angles for use on steel tools are:

Side and end clearance	3 deg.
Top side rake	14 "
Top back rake	0 to —3 "

These angles are based on setting the tool on center, or below, for an outside cut; or on center, or above, for an inside cut. It has been found difficult to insure maintenance of this setting with Carboloy tools, because of the widespread practice of setting ordinary tools ahead of center. It can be readily seen that, when working on a small diameter, only a slight advance of the tool ahead of center is sufficient to practically eliminate all clearance when only 3 deg. is used. Therefore, slightly different angles from the above are usually recommended. These angles are: side and clearance, 6 deg., top side rake 12 deg. This gives practically the same included angle to the cutting edge and compensates for a change ahead from the recommended setting. Meanwhile, the change in angles is not enough to be seriously detrimental if the recommended tool setting is maintained. On the softer metals such as copper and aluminum and some of the nonmetallic substances such as fiber and hard rubber, top rakes as much as 18 and 20 deg. are sometimes found to be beneficial.

If the nature of the application is such that a tool with side rake cannot be used, the same effect should be approximated, as much as possible, by using a positive back rake. This may then be as much as 12 deg., but it is not advisable to use a Carboloy tool having a flat top presented to the work if it is possible to avoid it. However, applications are bound to arise where a flat top tool should be used, such as single point threading tools and forming tools. The recommendations as to type of tool to be used, and the methods used to grind it, are based on the result of actual development work and tool application.

Rectangular tool bits of the type used in tool holders should never be used. While there is a definite and logical reason for the existence of this type of tool when using high-speed steel, there seems to be no excuse for its use with Carboloy. The very same reason that justifies using the high-speed steel tool bit makes it illogical with Carboloy, for when the steel bit is used, its size is kept to the minimum that will do the work, in order to save in the amount of steel used. But with Carboloy it is not practical to make a bit for the ordinary holder. Instead, a small cutting edge of Carboloy is attached to a steel bit of the proper size to fit the holder in question. The result, for a given size, is a much weaker bit, from which we expect to obtain more work since, in order to properly apply the Carboloy, the steel needs to be recessed to receive it. This means reducing the cross section of the steel, thus weakening it at the point where the greatest stress falls. By referring to Fig. 2 this can be seen clearly. As commonly used in the tool holder the cutting tip is unsupported and the greatest stress is set up on the section shown by the dotted line A-B. With the reduced section caused by inserting the Carboloy tip the result is usually a broken tool such as is shown in Fig. 3. The alternative is to replace the tool holder with a solid tool having a shank of the same size, with the tip directly applied to this shank. This gives a much better, and more satisfactory tool. If the same size tungsten-carbide tip is used, the tool is no more expensive than the bit, with the exception of the small cost for the extra amount of steel used. Furthermore, with a slightly larger piece of Carboloy, a tool covering a much wider range of application may

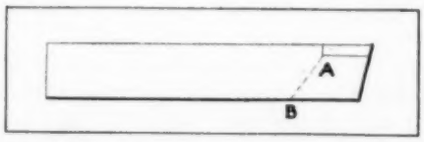


Fig. 2—Where failures are apt to occur in the tool

Fig. 3—Effect of using too light a tool for tungsten-carbide alloys

be had. Due to its similarity in appearance to steel, the mistake is common that Carboloy should grind like steel. But the very hardness of cemented tungsten carbide indicates that this cannot be so. It can, however, be shaped readily by grinding if proper precautions are observed, but not with the ease and speed with which steel can be ground. In grinding Carboloy special abrasive wheels should be used. Wheels for this purpose are now obtainable. Early in the development of tungsten-carbide cutting alloy, one of the largest abrasive wheel manufacturers in this country, realizing its possibilities and the need of proper grinding facilities, devoted a large amount of research work to the development of wheels for this purpose. The result is that a very satisfactory wheel is available at this time. Other manufacturers are now entering the field, and wheels of foreign make are also available.

Soft Grinding Wheels Are Necessary

A word of caution about the use of these wheels should be given. All of the wheels for grinding cemented tungsten carbide are very soft, therefore they do not have the same factor of safety as the harder wheels. While they may be run with safety at the recommended speeds, care should be taken that these speeds are not exceeded.

When grinding Carboloy nothing is gained by using heavy pressure. The rate of metal removal by so doing is only very slightly increased, while the rate of wheel wear is abnormally increased.

Machine grinding of Carboloy is difficult, and care must be used not to injure it when this kind of grinding is being done. The greatest cause of injury is cracking because of the development of excessive heat under the wheel, and chipping off of the edges. Grinding the tool is undoubtedly the operation where the greatest care must be exercised and where the most skill in handling is required. This does not mean that grinding is a difficult operation, but merely that it is a different operation, and the operator must be trained in the proper handling of this material if the best results are to be obtained. Carboloy may be ground by an inexperienced operator and apparently have a good cutting edge for the job at hand, and yet not give satisfactory service; while the skillful grinder may produce a cutting edge which to the casual observer looks no different but gives far better performance.

Off-hand grinding is the most satisfactory for general use. The flexibility of the hand support seems to contribute to the smoothness of the edge obtained. Of course, when doing this type of grinding, it is essential that the wheel run absolutely true and be kept dressed and free from glaze. When thus grinding, the tool should be traversed uniformly across the face of the wheel. It should not be fed in by direct pressure. The grinding should always be against the cutting edge and not away from it. In other words, the wheel motion, relative to the tool, should be such that any particular abrasive grain of the wheel will first strike the cutting edge of the tool and then travel across the face being ground.

Due to its low heat conductivity and lack of ductility, it is not safe to wet-grind Carboloy, therefore, as a matter of precaution all grinding should be done dry. This permits a more even temperature distribution and consequently cracking is less likely. When dry-grinding, the tool should never be dipped in water to cool. Nor should the temperature be permitted to become too high. Failure to observe these precautions is likely to be disastrous to the tool. Probably more tools have been spoiled by wet-grinding and by dipping than in any other way.

When grinding Carboloy, patience must be exercised, for it must be remembered that the material is very hard, that grinding is the only known way of shaping it, and that it responds to grinding, even under the most favorable circumstances, only slowly.

It is often necessary to obtain a finer cutting edge than that given by grinding. This can be done readily by lapping. It is only necessary to follow regular lapping procedure. For coarse lapping, silicon carbide may be used. For finer lapping the finer abrasives should be used. Boron carbide has been found to be very effective for this purpose. For very finest work diamond powder can be used. But is must be remembered that a keen edge, that is, a razor edge, cannot be obtained on tungsten-carbide alloys. This seems to be because of the structure of the material, it not having strength enough to prevent the edge from crumbling as keenness is approached.

It is realized that there are large possibilities of improvement in the tungsten-carbide cutting tool, and much intensive work is being done along this line. But the present tool is far removed from the experimental stage. Thousands of them are now in daily use. It has proven its worth in the field of practical application, and, if results are not obtained with it, there is something the matter with the application.

Boron Carbide as an Abrasive

By George S. Brady

BORON carbide is being employed successfully as an abrasive material in place of diamond dust in the lapping down of tungsten-carbide cutting tools, and at only a fraction of the cost of the diamond dust. Boron carbide is a fine, black crystalline powder of great hardness, practically equalling that of the diamond, and can be used for grinding the diamond. Its chemical composition is B_6C, and it is made of fusing together boric acid and carbon in an electric arc furnace under an extremely high temperature. An excess of carbon is used in the melting in order to keep out the air and prevent oxidation, so that the commercial boron carbide obtained always contains a considerable proportion of flake graphite which is formed in the process.

For lapping purposes the graphite mixed with the boron carbide is an advantage as it serves as a lubricant instead of oil. In lapping Carboloy, or other tungsten-carbide tools, the operation is performed on a revolving vertical disk and the boron carbide is applied mixed with water or kerosene. A uniform powder, of a grain size from 150 to 250 mesh, is used.

Modernization Number
May 16

Beginning a series of articles on

What Obsolete Equipment Costs

Time Out for Progress

By Robert R. Updegraff

When the executive says that he has no time for reading, he subscribes to a policy of refusing to meet the progressive men who write and record the forward experiences of industry

THE utterly incomprehensible thing about so many so-called practical business men is that they insist on being so utterly unpractical! They persist in learning everything for themselves by the costly and time-consuming process of experience, whereas much that they learn has already been learned for them and made quickly available.

The story has been told before, but is so to the point that it will bear repeating, of a New York business man who called in a well-known business counselor to advise with him in connection with a certain perplexing problem in his business. Three days later this business man received from the "expert" a lengthy report outlining how another company (name not mentioned) had worked out a similar problem. Accompanying the report was a bill for a sum in four figures.

The recommendation was just what was needed, and a check was mailed promptly and cheerfully.

It was fortunate for this executive's peace of mind that in clearing off his desk at the end of that week, he threw away without examining it a certain technical journal of his industry which had laid there for two weeks and which he had been "too busy" to read; for in that journal was the complete story upon which the expert's report was based. The only difference was that it was written more briefly and simply, and the company name was given so that he would have been in a position to get further details if he had wanted to follow it down!

One important reason for business failures, and a no less important reason for the slow personal progress of nearly all business men in comparison with their potentialities, is this busyness which results in blind dependence on their own little personal experiences.

Life—and particularly a man's business life—is far too short to learn everything from personal experience. The first 10 or 15 years, those terribly busy years during which so many of us are "too busy to read," are the great progress years; but no man, other than an absolute genius, can hope to crowd into his own personal experience all he needs to get out of these precious 10 or 15 years. Nor need he, for the experience of other men—most of them better men than he is, as yet—is available to him in books and periodicals.

How many men look upon books as merely printed pages between covers! Actually, books are reservoirs of human experience. And their cousins, the periodicals, are the streams of experience, flowing steadily along with the stream of life. To dip into either is helpful and stimulating; to drink from both regularly is to keep one's mind fresh and vigorous, and to let other men's viewpoints and experiences flow in to enrich one's own life and develop its potentialities.

It is all rot for any man to say that he has no time to read. He is merely admitting that he is not big enough to boss himself around, or that he is so egotistical that he thinks he knows it all already, which is worse. Dr. Arthur E. Bostwick, head of the St. Louis Public Library, put it squarely when he said, "He who complains that he has no time to read is one who does not fundamentally care for making contact with the minds of others. We always find time to eat. When we have realized that mental food is equally necessary to the maintenance of our intellectual life, we shall take as much time as is necessary for reading also." The trouble is that many busy business men fail to realize that books and periodicals are people, and usually exceedingly worth-while people. They waste hours every day in relatively profitless contacts with men with minds no bigger or keener than their own, while at their elbows are the ideas and experiences of scores of better minds that would inform them, entertain them, stimulate them.

> According to this writer books are the reservoirs of human experience, and periodicals are the streams of experience. To drink from both regularly is to keep the mind fresh and vigorous, and alert to the progress being made in our industries

Not that the less keen man does not promise himself to keep abreast with his fellows. He firmly intends to keep posted on what other men have found out and are finding out. He buys books and he subscribes to the journals of his profession, but he is "too busy" to carry through. He lets the physical presence of lesser men consume the time that he might be spending with minds of his own caliber—or higher caliber. He lets himself get so tired during the day that he doesn't feel like reading when night comes, and he doesn't read during the day because he is so busy making the wheels of the machine spin around that he has no time to look up from his work to see if the machine is going anywhere, or if so in what direction. He cannot bring himself to take a little time for progress, so he makes little progress.

The great need of any business man today is to keep abreast of progress, and regardless of the industry or field of thought or action, so well is the news of business now covered that the printing press keeps abreast of

Abstracted from an article appearing in the May number of *The Magazine of Business.*

progress all the time. It used to be that the great leaders of finance and commerce and industry were months ahead of the rank and file in their knowledge and plans. But it is difficult now for more than one or two people to know a thing without that knowledge being available to their competitors and to the business world at large. The strange thing about it is, that so many of us are so engrossed in groping along a narrow dark path of our choosing that we cannot take the time to raise the curtains of our own ignorance and let in the light of knowledge and experience along our way.

Where to get the reading time seems to be the big problem. Inasmuch as reading means progress, it would seem as though the business man could afford to make it one of his major business concerns, and that as such he might well plan to devote part of his business day to it, rather than depend on his evening hours, when he ought to be free from business and its problems.

I know all the objections. We all do. We have all made them. But I know, also, the president of one of the fastest growing mercantile businesses in this country, with more than 500 branches, and with more pressing problems and more detail than confronts almost any man of my acquaintance, and he takes part of nearly every day for reading. "I read because it keeps my mind stimulated," he said. "Of course, I do pick up ideas, and I do, both consciously and unconsciously, acquire policies and principles that other men have found effective and apply them to our business. But the biggest thing I get from reading is that it keeps my mind alert and moving forward every hour of the day."

Reading Stimulates to Progress

The man who expects every hour of his reading to develop definite ideas that come from outside of himself will very possibly be disappointed with what he gets from a given number of hours spent in reading, but he can never be disappointed in the stimulus to progress that will come from regular exposure to the currents of life that flow through our periodicals, and the experiences and ideas and viewpoints that the world's thinkers have set down in print.

One of the most successful manufacturers I know, and an old hard-shell of whom it would never be suspected, confessed to me recently that for years he has made it a rule to devote one hour each day of his office time to reading. He told me that when he first made the bargain with himself to do this he found it almost impossible to accommodate the affairs of his day to the plan, but that by perseverance it was managed, and the very licking of that problem gave him a self-respect and a sense of control over his job that moved him forward several points in his effectiveness. Even then, it took some weeks before he could relax while reading at the office.

I am convinced that any man who will set aside one hour of each day regularly for reading which puts him in contact with the thoughts and experiences of his fellow men, will more than make up for the hour he gives to it by enlisting in his work the ideas and experience of a score or a hundred capable men who will take hold of his job with him and help him to travel forward at a rate that will astonish him. Nor does it make so much difference what he reads; it is the stimulus of keen minds and fresh ideas, and the opportunity the subconscious mind gets to work on the problems of one's job while the conscious mind is vacationing in a book or magazine, that count in progress.

SEEN · AND · HEARD

By John R. Godfrey

Experiences with tungsten-carbide cutting tools—Shrinking bushings in liquid air

ONE of my progressive friends who has been trying tungsten-carbide tools for quite a period feels that while they are not "cure-alls" for all machining problems that they have distinct advantages and in many cases pay good dividends in spite of the high initial cost. While his experience on rough turning has not been entirely successful he feels that with proper machine tools and other conditions, it is superior to any other cutting tool.

Where both roughing and finishing cuts are done on the same machine he uses high-speed steel for the first cuts and tungsten-carbide tools for finishing, even at the same speed as before. The economy comes in the life of the finishing tools where great accuracy is required, as in the finishing of ring grooves in pistons. In work of this kind he finds a life of at least 50 to 1 for the new tools. This reduction of set-up time for the finishing tool is a big item in the total production and in the elimination of scrap due to trials after a new set-up. He feels that it may pay to increase the speed from 10 to 12 per cent, even if it means grinding the roughing tools more frequently, as they are easily replaced.

Where the operations are split between two machines the new tools can be used very successfully at considerably higher speeds. For, in using the new tools on finishing work only, we eliminate a large amount of set-up time and the accompanying idle time of the machine. Fewer men are needed in tool maintenance, and much of the cost of inspecting the tool set-up is eliminated. There is likewise less investment in tool maintenance apparatus.

As with all improvements, there are points to be considered on the other side, and no one tool or method is best for all work. But there is little doubt that we are to see faster machining operations, and that machines will be so developed as to permit the full value of the new cutting alloys being secured.

* * * *

A CASE that reminded me of the putting-on tool was the shrinking of bronze bushings into an aluminum casting. The casting was large and would have been distorted by heating it sufficiently to shrink in the bushing. So instead of expanding the casting the bronze bushings were *shrunk* and dropped into the casting to expand into place.

After securing of a few quarts of liquid air, the bronze bushings were dipped in the liquid air, and cooled to about 300 deg. below zero, which of course shrunk their diameter. The casting was barely warmed, below the temperature of boiling water. Placing the cold bronze bushings in the castings they soon warmed up to room temperature and were held firmly in place.

Liquid air is not new. I saw experiments with it thirty years ago. But this is the first time I've seen it used in machine shop work. It's worth remembering—it may help you out on a difficult job. But, remember that it must be handled very carefully.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Picking Men in Cheerful Surroundings

"WHAT'S that flossy looking room they are fitting up down near Williams' office, Al?"

"That's for interviewing men who want a job, Ed. Williams has been trying to get the old man to fix that up for a long time."

"What's the big idea, Al? Of course the old employment office was a bit mussy and not very pleasant. But why all the easy chairs and pictures and other things?"

"It's Williams' and Blake's idea. You know Blake, the new personnel man, has a lot of notions, but when Williams backs them up, I'm inclined to believe there's something in 'em.

"Blake puts it something like this—'It costs real money to hire and fire men. If we can cut down our mistakes in hiring the wrong man, it will save us a lot of money. So we can afford to spend a little more money in the hiring end and have less firing to do.' "

"But why all the frills, Al? Why should the firm spend good money to entertain a man who wants a job? He's looking for work—not easy chairs and pictures."

"Crabbing again, Ed. But just let us suppose you were out of a job and applied for work at a place where they talk to you—or at you—through a peek hole.

"You couldn't half see the man who was hiring and he wouldn't know what a well set-up looking bozo you are by just seeing that face. You couldn't half tell him your good points and he couldn't be sure whether you were lying to him or not.

"Suppose now, you came into a comfortable, cheerful room, where you could tell the interviewer how good you were without squinting up one eye to look at him? He'd size up your classic features and manly frame, and he could come a lot nearer knowing whether you were telling him the truth about your experience. Besides, you'd feel a lot better about taking a job where they treated you white."

"Might be something in that, Al. But it seems to be all on the side of the man you're hiring. Where does the firm get off?"

"By making fewer mistakes in hiring the wrong man, Ed. And also by making a man want to make good after he's had a good reception right from the start."

"Well, I hope they'll pick better men than they have sometimes, Al."

"You'll get a chance to look 'em over too, Ed, before Blake sends you a man. But you're expected to use horse-sense, and not turn a man down just because he wears a brown derby, or if you don't like his necktie. Try and size up the man himself."

Is Al right in feeling that an attractive room will help get better men? Or is Ed's idea that it's a waste of money the right way to look at it? Will Ed be apt to get better men if he looks them over before they are hired?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

An Unemployment Fund

I WAS working in a factory a few years ago, where a method of abolishing unemployment was in force. This particular factory employed a force of five hundred employees and manufactured the greater part of their products during a short season, thus necessitating the dismissal of a large number of the working force between these seasons. The people employed were of the skilled type, and when dismissed they migrated to distant towns, or else were compelled to lay idle until recalled to work. It was not an easy matter to secure this skilled class of labor at any time we required it, and we also realized that the hardships which we were placing on our help due to this practice, was not creating the team work which was necessary to carry on production. With this thought in mind our factory manager conceived the idea of placing a certain amount of the company profits aside at the end of the year and using it for general factory overhauling and repairs when these slack periods occurred. This kept the force occupied during the dull times.

—Fred Aug. Schmidt, *Industrial Engineer.*

More Responsibilities for the Foreman

THE foreman is responsible for the work of his men, and our foremen have learned that there is no better method of controlling it than to watch the first piece. Only by this method can faults be remedied at the minimum cost.

Another feature of this method is that it forces contact of the worker with his foreman and every executive understands the value of such contact. With it, bad work can only result when both foremen and workers are neglectful.

My foremen consider this method as their most effective help, and would not like to have the inspection of the first piece made by an inspector. They hold that the one to inspect it is the one who is able to judge its quality, not only its correctness, and I think they are right.

—Franz Bermann.

Letting Small Savings Offset Larger Wastes

A CHECK system should be utilized to account for and locate all tools. Workmen upon being employed should be provided with a stated number of tool checks which they will leave at the tool crib each time they withdraw a tool. Tools for general use should be issued to the shop only upon request of the foreman, or an order from the planning department, depending upon the system of tool control in operation. In either case a check should be demanded from the workman, and placed at the storage location of the tool.

—Arthur Fruncillo.

IF THE shop keeps any accurate records, as of course it should, it certainly will know how many drills each operator uses, whether they are issued one at a time or a dozen at a time.

Since it is obviously a saving in time and effort for the operator who has to get them, for the clerk who has to write the requisition, for the foreman who has to O.K. it, and for the toolcrib man who has to hand the requisitions out, why not issue a dozen new drills, in a sealed envelope, instead of going through the whole performance twelve times?

There is an additional point to be considered. Any experienced foreman will agree with me that many small tools are broken just because they are not replaced by sharp ones as soon as they have become dull. This is true of drills, taps, reamers, and especially of the tools which form the "set-ups" in automatics.

—H. J. Gustav Kopsch.

The Exit Interview

ONE of the most expensive items of shop operating costs is labor turnover. Aside from the clerical work involved, the cost of production always mounts when a new man is placed on the job. Workmen are dismissed or resign from employment for a multitude of reasons, ranging from incompetence to being offered a better job. Anything which will give information that can be used toward lessening this evil is of value. While the exit interview may seem to imply a lack of confidence in the foreman, yet a frank talk with a skillful investigator may reveal some fact or condition which can be modified, thereby adding to the stability of the personnel.

Quite often men are placed on the wrong kind of work; or, again, too severe a demand is made on them. They may be lacking in the experience or temperament to adapt themselves to the job. At any rate as soon as he possibly

THE · NEXT · TOPIC

Stirring Up the Foreman on Accidents

ADVANCE QUESTION

A shop man falls into a pulley because the guard hadn't been put back in place. Williams stirs up the foremen by insisting on more attention to safety. Ed thinks he's too insistent. Al doesn't agree with him.

can, the foreman should analyze the capabilities of the new man and start training him to hold down any job to which he may be assigned. In this way, as long as there is work to do the foreman is developing his men and assuring himself of a force of competent workers who will stay on the job and not drift from shop to shop.

—L. O. Brown.

Shall Men Clean Their Own Machines?

MACHINE cleaning by steam or compressed air can hardly be claimed as a new thing. Both have been used for this purpose for many years. The objectionable part of this method is that when used by the operator of the machine, the flying particles often cause damage to the eyes and other parts of the body.

I am unable, however, to get away from the idea that the good workman is really interested in his job and his own particular machine and will, if given a chance, take good care of and keep his machine clean. In shops where I have been foreman, I have checked this cleaning operation and have found but few instances where the time given to cleaning is abused. As a machine shop instructor, after twenty-five years' experience as a machinist I see to it that the boys who come under my instruction are most assuredly given instruction in the advantage of cleaning their own machines.

—James B. LaVielle, *Machine Shop Instructor, Denver Opportunity School.*

Helping the Tool Designer

THE competent designer knows how to design his tools to produce a satisfactory product, but quite frequently the foreman of the department or operator of the machine tool for which the fixture is designed will know something about the safe speed, capacity, and accuracy of the machine to be used, which may influence the design of the equipment to an appreciable extent.

The designer should be willing to use a good suggestion from a shop man, but if he does not approve of it the tool should be made as the designer thinks best and not to suit the foreman.

—Thornton Packham, *Tool Designer.*

PAST experiences have proven to me as tool designer, that a discussion on the design of tools and fixtures with the foremen under whose supervision the tool is to be used, is generally satisfactory, but judgment must be used by the designer as to how far he may go.

There are many tools where a discussion with the foreman is unnecessary, but there are other instances where it proves to be of great help, and that is particularly true when a complicated fixture is to be designed. There are a lot of points that are overlooked from the designers standpoint or that he may not know of, but through a careful discussion with the foreman these facts may come to light. —Fritz L. Keller, *Tool Designer.*

WHILE the foreman is not required to assist with the design of fixtures, how in decency can he refuse if a request is made in the right spirit?

However, the foreman may not have given the design of fixtures much thought, knowing that a man for that purpose is on the job, or he may not have the time, in which case he will have little to offer and a frank statement will make his position clear.

Collaboration will get the best results. How much better to have a designer who is open to suggestions than one of the kind who is so imbued with his own ability and superiority that he will not deign to ask for suggestions. I know of several fixtures designed by such men at an expense of several thousand dollars, that are now gathering dust in the crib, but could be at work if a little conference between foreman and designer had been held before they were made. The foremen were not sorry to see the designer fall down, but it cost money. The foreman is the one who must get out production.

—George Wilson.

Shall a Man Sit Down to Work?

IF YOU respect a man's judgment, you shouldn't insult it by arbitrarily issuing a rule against his sitting down to his work. More important decisions and responsibilities are part of his ordinary routine, so why single this decision out and remove it from the scope of his judgment. If, however, he uses bad judgment and sits down to work that really requires him to stand up for the best results, why not correct him on the basis of facts, rather than a mere arbitrary rule?

A man should never be bawled out in front of a visitor, nor even in front of a fellow worker if it can be avoided. In private, a worker feels free to calmly state his case if he disagrees with you, but in public he knows he has to hold his tongue and take it—and he hates you for the unfair advantage you have taken of him.

—John T. Thompson.

IT IS important from the standpoint of good shop morale that the foreman represent the men in their contacts with management policies; and, if by any chance these policies appear to inflict an unnecessary hardship on the men. Hence it is, that while a foreman can properly insist on obedience to the wishes of the management, he should do so with full appreciation of the other fellow's side.

As to the question of sitting, this is just another of those cases, that circumstances alter, and each job must be considered on its own merits. Censuring an employee in public is a sign of poor foremanship, reflecting itself in lowered morale, unfriendly feelings, lack of confidence, and impaired efficiency. —D. C. Wright.

EVIDENTLY the Tucker plant is a relic of the old days, when the employer had little or no consideration for the welfare of the employee. In order to get the most out of a man, he must first be made comfortable, and secondly, he must be allowed a necessary amount of rest. A normal man does not sit down at his work unless he finds it more convenient to do so. If standing is easier, he will naturally take that position. However, if he is forbidden to sit down, he will leave his machine on any pretext and waste more time than if he were allowed a proper amount and kind of rest.

Students of labor conditions have found that the way to get the most out of an employee is to allow him or her to take the position that will be most comfortable.

—S. H. Pearson.

Equipment for Making Sheet-Metal Brush Strips

By F. H. Mayoh

A combination of an automatic machine and hand-operated fixtures for the economical production of brushes

PROBLEMS for analysis that differ from the usual run of machine-shop practice are brought out in the manufacture of special machinery. An example is in the machines for the manufacture of what is known as hair strip, such as is employed in the production of many forms of hand- and wall brushes of the type illustrated in Fig. 1. The bristles are clinched into a metal strip made into a continuous unit from a coil of soft, rustproof steel, or brass, which is cut to length, formed, stuffed with bristles and clinched, all in an automatic machine, the principal functions of which are diagrammatically illustrated in Fig. 2. In Fig. 3 is shown in detail the construction of the brush strip, together with some of the shapes that go into the making of brushes.

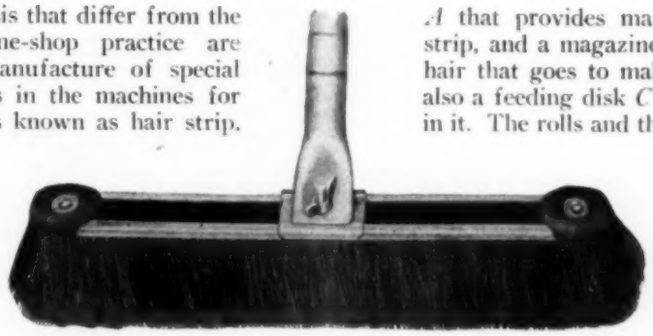


Fig. 1—A complete brush

A flat strip of metal is rolled into one of the shapes shown at *A* and *B* in the end views at the top of Fig. 3. Inside of the rolled strip is either a round wire *C*, or what is known as a dumb-bell shaped wire at *D*. The bristles are looped about the wire, and are securely clinched in place by the metal strip. The shape of the wire, in conjunction with the tightness of the rolling, governs the amount of outward flare of the bristles. It is desirable that the bristles be tufted, that is to say, that they should flare outward in separate groups, as shown at *E* in the side view at the left. Tufting makes a stiffer brush and one that is easily kept clean, although this feature is not easy to obtain. In the brush shown in Fig. 1, the bristles are not tufted. Referring to the diagram of the machine in Fig. 2, it will be seen that there are eight horizontal and four vertical rolls, the two rear vertical rolls being hidden by the ones in front. In addition, there is a reel of wire at the upper right at *A* that provides material for the center of the strip, and a magazine at *B* in which is placed the hair that goes to make up the bristles. There is also a feeding disk *C* having receiving notches cut in it. The rolls and the disk are connected together by gears or chains so that they operate in unison to perform their functions. The bristles that go into the brush are cut to length and are so placed in the magazine that they will lie crosswise of the metal strip that will confine them. The lower end of the magazine is narrowed so that sufficient bristles only are allowed to pass through at one time to make what is known as a tuft, a tuft being indicated at *D*. As the tuft leaves the magazine, it enters one of the notches in the feeding disk. The disk is indexed rapidly in the direction of the arrow, so that the tufts are laid a short distance apart on the strip of metal as it is formed by the rolls. A weight is put on top of the bristles in the magazine to force them to the bottom of the opening and into the notches in the disk. The disk is beveled on the edges so that it will enter the partly-formed strip. A guide retains the bristles in place until they reach the metal strip and until they are clamped into the strip by the center wire. The wire holds the bristles in place through the closing rolls until the metal strip is formed into a compact unit. The wire is drawn from the reel through the medium of the forming rolls, which act as a feeding mechanism by pinching it during the forming process. As the strip of metal goes into the machine, it passes between the pair of rolls *E*, and then through the pair *H*. The rolls *H* revolve slightly faster and bind a little harder than do the rolls *E*, so that the strip of metal ribbon is always under tension. The shapes of the rolls *E* and *H* are indicated at *J* in the upper part of the

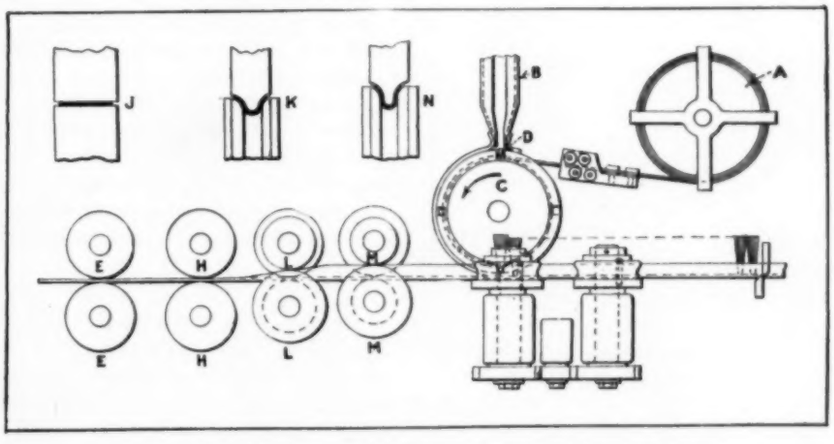


Fig. 2—Diagram of forming and assembling machine

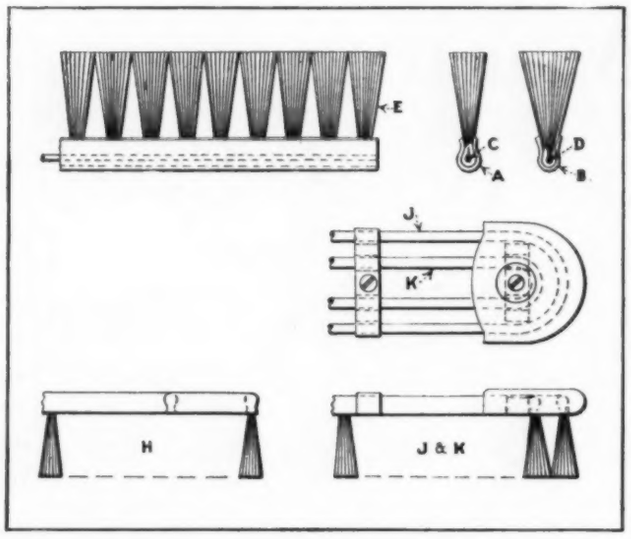


Fig. 3—A group of formed brush sections

illustration, while at K is shown the shape of the pair of rolls L. Rolls L partly form the metal strip, and the rolls M, of the shape shown at N, complete the preliminary forming operation and prepare the strip for the bristle assembling. The strip next passes between the first pair of vertical rolls, which are driven by gears having a pitch diameter equal to the diameter of the rolls.

Before the strip passes the center line of these rolls, the tufts of bristles are implanted in place and the center wire is laid over them so that they are securely held. When the metal strip passes through the first pair of vertical rolls, it is forced into shape and thereby clinches the bristles and the center wire in place. The next pair of vertical rolls set up the unit more tightly. The operation of clinching gives to the bristles a natural flare, as shown in the end views in Fig. 3. The strip is cut off by a pair of shears at the right side of the machine. The shears are automatically operated and are adjustable to cut various lengths.

It should be observed that the feeding disk is grooved for the wire to a depth below that of the notches, and

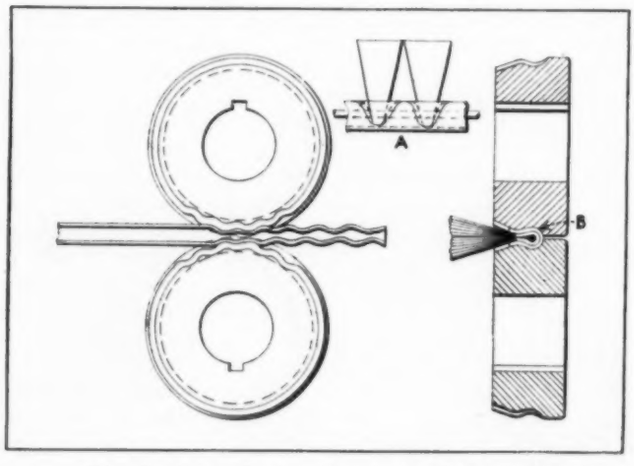


Fig. 4—Method of rolling tufting indentations

that, as a matter of fact, the notches are quite shallow, their depth being shown much exaggerated in the illustration.

The closing rolls shown in Fig. 4 close the metal strip in such a way as to retain the bristles in their tufted position. Both of the rolls are corrugated throughout their entire circumference, so that they indent the strip to the shape shown. The appearance of the closed strip is shown at A, while at B it may be seen as it is passing through the rolls.

The brush strips described are formed to various shapes for the many purposes for which the brushes are to be used. The brush end shown at H, Fig. 3, is an example of a strip having a plain, looped end. This strip is about ten inches long and two inches of the bristles have been cut from it at the left, so that the end can be inserted in a handle. At the right, the two strips indicated as J and K form the inner and outer portions, respectively, of a floor brush. The strips are held together by metal clips and the ends are protected by rubber bumpers.

Bending fixtures are provided for forming the brush strips to shape, and it has been found that hand-operated

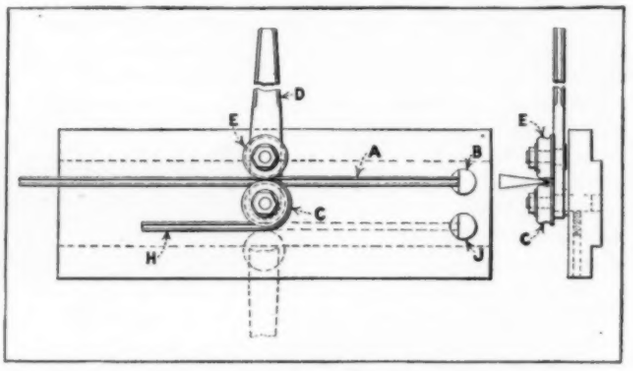


Fig. 5—Fixture for bending brush strips

fixtures, held on a bench or in a vise, answer the purpose admirably, owing to the large variety of shapes of brushes to be made. In Fig. 5 is shown one of these fixtures. The brush strip is indicated at A. It is brought against the pin B, which acts as a stop to gage the endwise location relative to the forming roll C. Pivoted to the stud of the forming roll is the lever D, on which is mounted the roll E. The brush strip is slipped between these two rolls and against the stop B. Lever D is then pulled to the right, bending the strip to a half circle and bringing the end to the position shown at H. The partly-formed strip is now swung half-way around the center roll, bringing the lever into the position shown by the dash-dot lines, the long end of the strip being brought against the stop J. The lever is now swung to the left, bending the long end of the strip to the counterpart of the bend made before. The two ends are then sprung out at the center, making an opening sufficient to allow the strip to be removed from the rolls. The meeting ends are held together by a clamp.

At first glance, bending fixtures such as the one shown appear to be out of line with modern manufacturing methods, being hand operated. However, since the operators become quite skilled in their manipulation and consistently bend about forty strips per minute, they have been found to provide a most economical means of doing the work.

"Peralitic" cast iron, and "high-test" cast iron are recent developments of the foundry to meet the competition of welded steel construction. Superheating the cast iron in the cupola, and also adding to the mixture small quantities of nickel, chromium, or other elements are some of the ways in which a stronger iron is obtained.

· BOOK · REVIEWS ·

HISTORY OF MANUFACTURERS IN THE UNITED STATES. VOL. I. By Victor S. Clark. Six hundred seven pages, 7x10 in., cloth board covers. Indexed. Published for the Carnegie Institution of Washington, by the McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York. Price $15 for the three volumes.

THIS work, which is a revision and extension of the author's original history of manufactures brought on in 1916, is the result of research work begun in 1904 and continued ever since. It is an impressive compilation and well-digested summary of the important steps in the history of manufacturing in the United States from early Colonial times. The first volume covers the period from 1607 to 1860; the other two volumes will be published later and will bring the history down to the present date.

The purpose of the book has been to get away from the tiresome textbook style of recording in great detail all points, and to present the significant facts that show most clearly the forces that have shaped the development of American manufacturing industries. At the same time he has quoted freely the authorities for these facts. The volume makes highly interesting and comparatively easy reading. The subject matter is grouped topically in chapters instead of following precisely by date. There are 20 topic chapters, and a general summary review of the pioneer period. The topic divisions cover such points as: Influence of natural resources and markets, Colonial legislations affecting manufactures, Influence of transportation, Currency and prices, Relation of capital and labor, Foreign influences, Capital, profits and wages in manufactures, and Technical progress in manufactures.

BAUELEMENTE DER FEINMECHANIK. By O. Richter and Dipl.-Ing. R. von Voss. Five hundred seventy-six pages, 6½x9½ in. One thousand eight hundred fifty-two illustrations and thirty-six tables. Bound in cloth boards. Published by VDI-Verlag G.M.B.H., Berlin NW7, Germany. Price 29 rentenmarks.

IN THE introduction to this book the authors say that while exhaustive treatises on machine design, with the emphasis on heavier machinery, have long been available to students, engineers and designers, no such facilities have been provided for those interested in the designing and making of the smaller machines, devices and instruments, such as clocks, watches, electric meters, typewriters, sewing machines, signaling apparatus, scientific instruments, control apparatus, and the like.

The first section deals briefly with the materials used in products of the type mentioned. Then comes a section on fastenings which is followed by one on bearings of all sorts. The next section takes up the various means of transmitting power, and the final one covers control devices and elements.

The book is lavishly illustrated with line drawings of the various mechanisms and elements described in the text. As a consequence it should be useful to engineers whose command of German is not of the best. So far as the reviewer is aware there is no exactly comparable book in English.

ANALYTIC MECHANICS. By Joseph B. Reynolds, Ph.D., professor of mathematics and theoretical mechanics, Lehigh University. Three hundred forty-seven pages, 6x9 in. Published by Prentice-Hall, Inc., New York. Price $4.00.

ANALYTIC MECHANICS is intended primarily for students in engineering schools and colleges. The development is such that, with some omissions, the text can be used where a course in pure or theoretical mechanics is desired. In kinematics, the foundation required is a working knowledge of analytic geometry and the calculus; in kinetics, a working knowledge of elementary mechanics and kinematics is required.

The author has put into this text about 700 graded exercises, most of which are original. About one-fourth as many illustrative examples are solved and explained in order to demonstrate the method of applying the principles developed. It is believed that these exercises, on the whole, will not be found too difficult for any student prepared for the study of analytical mechanics; yet a few will test the powers of the brightest student. Care has been exercised to adjust the data, where possible, so that the student will not be lost in a maze of arithmetic, thus losing sight of the principles involved.

PROCEEDINGS OF THE THIRTY-FIRST ANNUAL MEETING, A.S.T.M., Parts I and II. Eleven hundred eighty-four pages in Part I and nine hundred four pages in Part II, 6x9 in.; paper, cloth, or half-leather bindings. Published by the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa. Price $6 in paper, $6.50 in cloth, and $8 in half leather.

PART I of this valuable record book contains the annual reports of 45 committees of the Society. These reports include studies made on metals, oils, and other engineering materials. It includes methods of testing of various materials, together with tables and charts. It also contains 81 tentative standards, most of which are published for the first time.

In Part II are given 46 technical papers as presented by experts in the various lines, and the discussion on these papers. Such subjects as nickel and nickel alloys, fatigue properties of cast iron, corrosion fatigue, wear tests of manganese steel, and wear test of bearing metals are discussed. In connection with the articles on the testing of materials new testing apparatus is described.

PRACTICAL RAILWAY PAINTING AND LACQUERING. By H. Hengeveld, master painter, Atlantic Coast Line Railroad; C. P. Disney, bridge engineer, Canadian National Railways; and William J. Miskella, director, Finishing Research Laboratories, Inc. Two hundred sixty-seven pages, 6¼x9¼ in.; one hundred sixty-four illustrations. Published by Finishing Research Laboratories, Inc.; distributed by the Simmons-Boardman Publishing Company, New York. Price $3.50.

IN THIS fourth volume of a nine-volume series on finishing, the first 141 pages are devoted to information of a general nature, mostly on equipment for lacquering and painting, and data on lacquers and paints. The remaining pages are devoted to practical data on the finishing of rolling stock, signal equipment, bridges, buildings and water service. The book should be useful to the railroad shop man who is seeking practical finishing data.

The Lancia

Fig. 1—Facing the mating surfaces on a small Bullard boring mill. The piece registers horizontally on four pins and vertically against three fixed, and one spring support

Fig. 2—Finishing the shaft end on the same mill as used for Fig. 1. The fixture is countersunk to accommodate the four strap supports

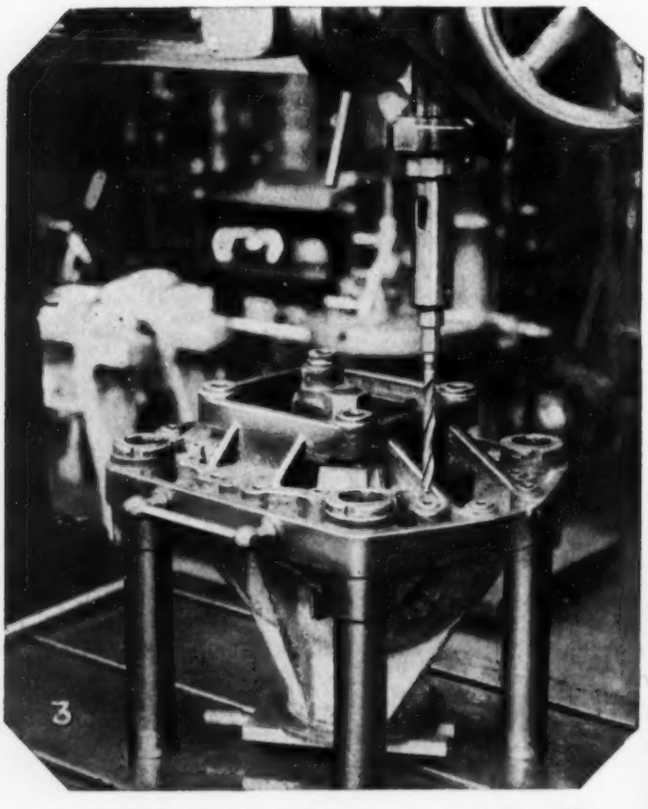


Fig. 3—Drilling the back flange and strap supports. The casting is held against the jig by a central bolt

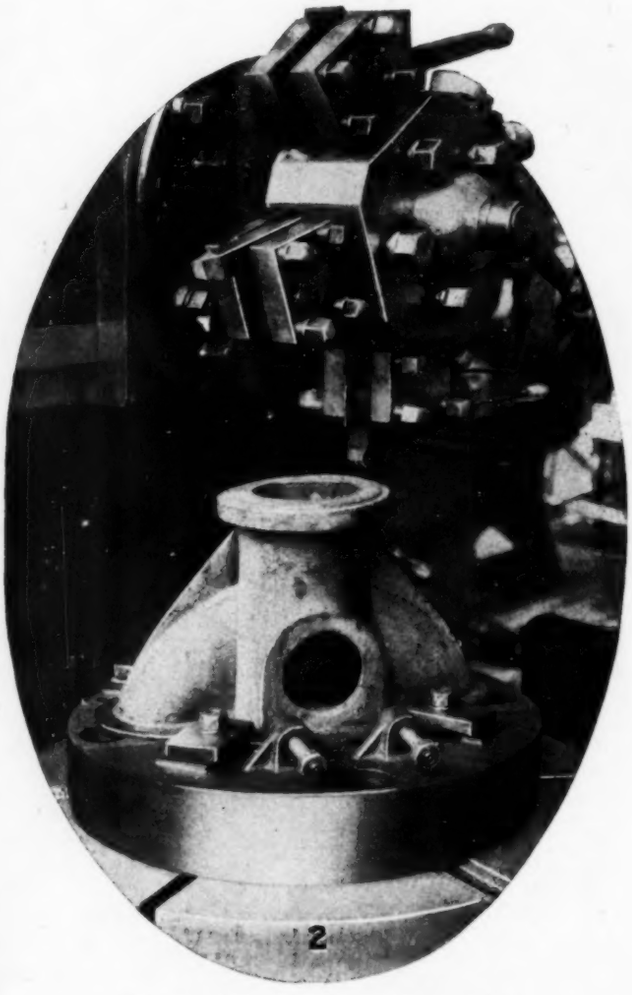
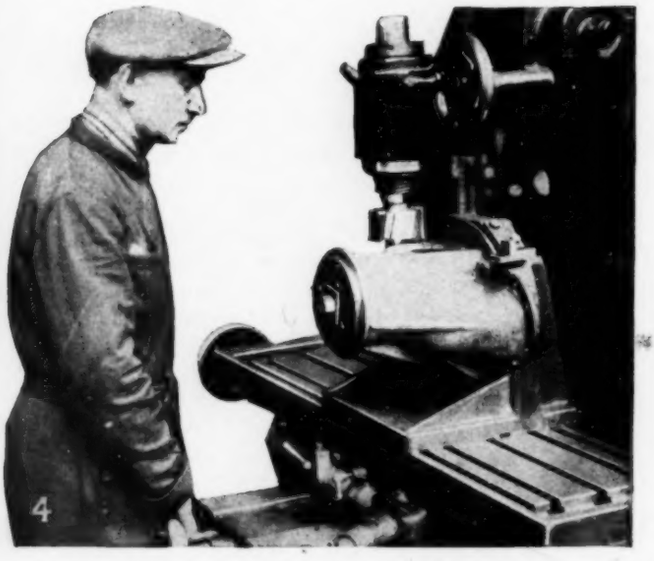


Fig. 4—Milling the inspection opening



Differential Housing

Photographs by courtesy of the Lancia Company, Turin, Italy

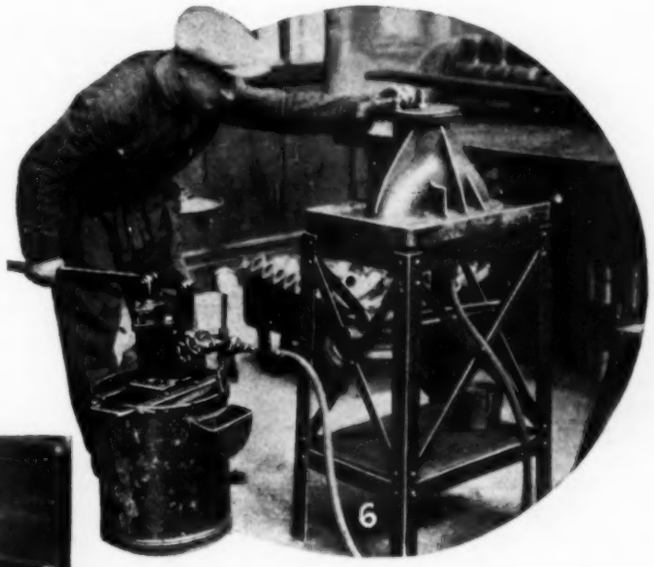


Fig. 6—After the machining operations are finished, the housing is given a hydraulic test for oil tightness

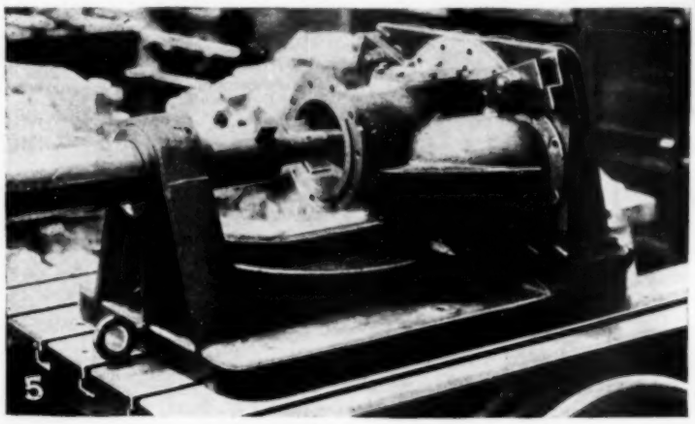


Fig. 5—Boring and facing the seat for ball bearings. The first cutter finish bores the clearance hole, and the second one finishes the bearing diameter and the face of the flange. A bearing in the outboard end of the fixture supports the outer end of the bar

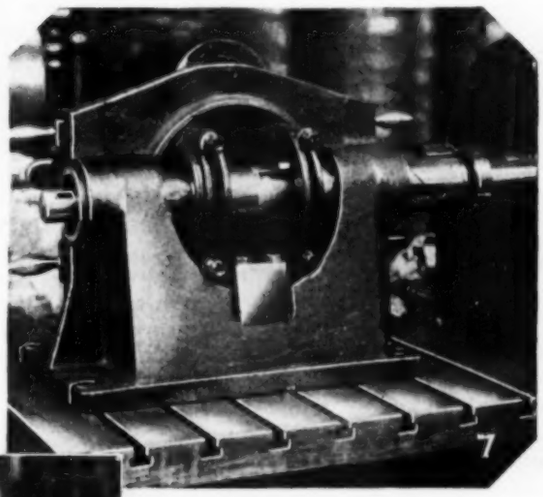


Fig. 8—The completely machined housing removed from its fixture and ready to receive the differential unit. After the unit is in place the whole is ready for assembly to the axle housing

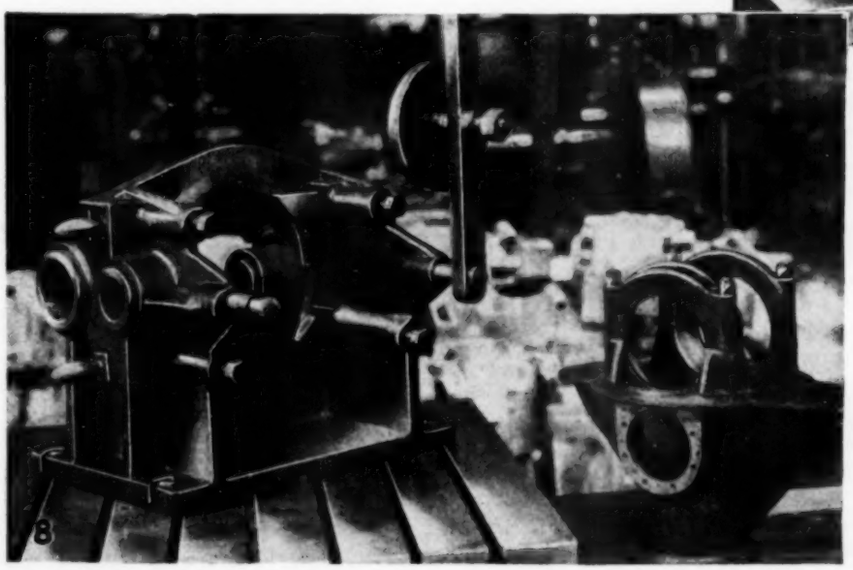


Fig. 7—After several minor operations are performed on the straps that hold the bearings for the large differential gears, they are assembled to the housing and bored with it

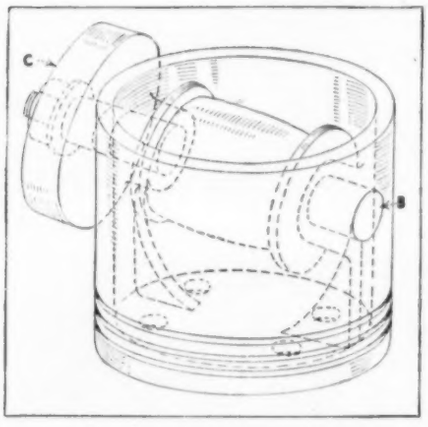
IDEAS · FROM · PRACTICAL · MEN

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

Using a Piston As a Grinder Stand

By Robert L. Efurd, Jr.
Tolbert-Efurd Welding & Machine Company, Inc.

A discarded piston, used as a grinder stand on the lathe, has advantages over some of the regular tool post grinders. Having a heavier spindle, with bearings further apart and supported all around, it will take a heavy cut without chatter. The one shown in the illustration was made from an old 10-in. piston, sawed off just below the wrist pin holes. The holes were then bored out to receive roller bearings, as at *B*. The shaft extends from one end and is fitted to receive a standard wheel. A flanged pulley is fastened to the shaft between the bearings and a wide pulley is used on the countershaft to permit the belt to traverse.



Sturdy grinder made from an old piston

This rig can be bolted to the back end of the lathe carriage, or clamped to the tool block. If it is desired to get closer to the work, the skirt may be cut away on one or both sides.

In using this grinder clamped to the tool block, I have found it possible to do work that an ordinary toolpost belt-driven grinder would not touch, and inasmuch as a 2-in. belt can be used a fairly heavy job can be done with it. I have also used it with a cup wheel to grind flats on rods.

Making Aluminum Coil-Forms

By Charles H. Willey

Among the tools in use in our plant are the ones shown in the illustrations, for making forms for the moving coils in electrical meters. We make from 150,000 to 200,000 of the forms per year and the tools give very good results.

The forms are made from round aluminum tubing, $1\frac{1}{8}$ in. in diameter and 0.0025 in. in thickness. We purchase the tubes in long lengths and cut them into 3-ft. lengths for easy handling in a small, high-speed lathe, in which they are held in a collet.

The tool used in this operation is illustrated in Fig. 1.

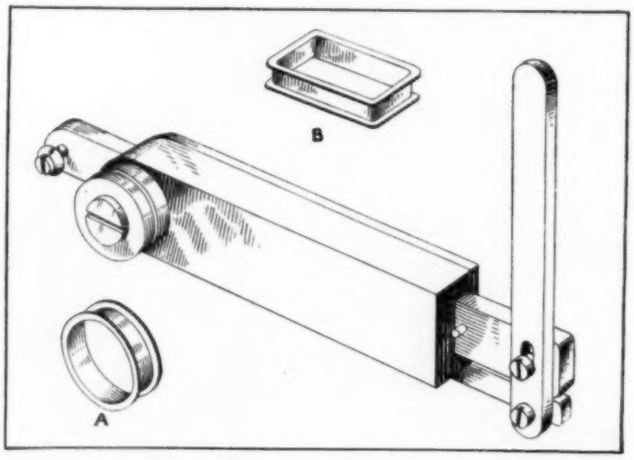


Fig 1 — Tool for cutting off tubing and forming flanges

It consists of a bar fitted to slide within a case, and carrying at one end a small circular cutter. At the other end is a lever for moving the bar in the case, which is held in the toolpost of the lathe. At the end of the case nearest the cutter is a forming roll.

In operation, the tubing is fed by hand against the bar and the lever is pulled toward the operator. The cutter is thus brought against the inner wall of the tube, forcing it against the forming roll. As the pieces are cut from the tube, flanges are formed, one on the piece and one on the end of the tube. The first piece is, of course, wasted because it has but one flange. As the end of the tube is left with a flange, cutting off the next piece forms the second flange and again leaves a flange

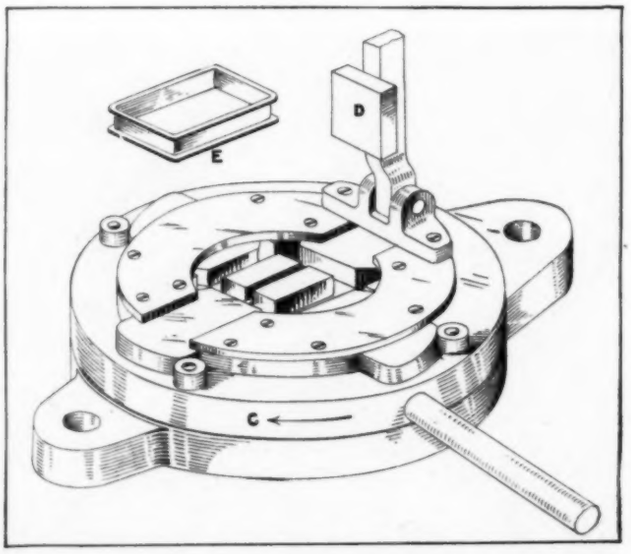


Fig. 2 — Finish-forming tool complete

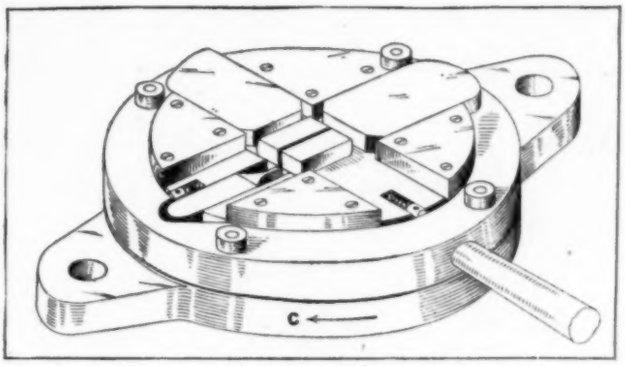


Fig. 3—Finish-forming tool with cover plates removed

on the end of the tube. At *A* is shown one of the pieces cut off.

The next operation is that of rough forming the pieces to a rectangular shape, as indicated at *B*. This is done by placing them over an expanding plug in a foot press, the plug being expanded by a wedge moved by the press ram. The roughly-formed piece is then placed over the expanding form in the tool illustrated in Fig. 2. In this illustration the tool is shown complete, while in Fig. 3 it is shown with the cover plates removed. In this tool are six slides, four on top for squeezing the piece, and two below for expanding the form, all of which are operated by rotating the ring *C* in the direction of the arrow.

In operation, the roughly-formed piece is placed over the expanding form and the lever at the rear is brought down so that the pad *D* bears on the piece and prevents it from rising. When the ring *C* is rotated, the four slides on the top are forced inwardly by rollers, and the two slides below are forced in the same direction by cam slots in the ring. Wedges on the two lower slides expand the form, while the four upper slides press the piece against it, finish-forming the piece into a rectangular shape, as shown at *E*. The pieces are then placed on a rectangular mandrel, 25 at a time, and the edges of the flanges are filed smooth and square.

A Universal Driver for Lathes

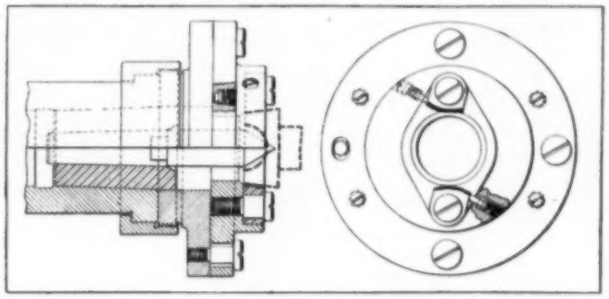
By H. L. Wheeler

Turning operations on work that is supported on centers, either in engine lathes or in automatic lathes, are greatly simplified by the use of the universal work-driver shown in the illustration. The device as shown was made to fit a Fay automatic lathe, but its design can be modified to suit any other lathe. It eliminates the use of ordinary lathe dogs.

The use of ordinary dogs on automatic lathes has many disadvantages on account of the heavy cuts taken by multiple tools. The operator must use extra force to set the dog screw tight enough to drive the work under heavy cuts. In a short time the dogs are weakened and will show signs of slipping. Sometimes they do slip and destroy the set up, causing delays and extra work for the set-up man.

The back plate of the device is machined to fit the spindle of the lathe and carries the driving plate, which floats on the holding screws through elongated slots. The driving dogs are made of tool steel, hardened and ground, and fit into pockets machined in the driving plate, being held in place by shoulder screws. The driving is provided with four pressure plugs, actuated by springs and having means of adjusting the pressure. The pressure plugs bear against the back plate and set up sufficient friction to prevent the driving plate from slipping down when the work is removed and to keep it in a relatively central position at all times.

The driving dogs are fitted into their respective pockets so that their round ends bear against corresponding surfaces in the pockets and relieve the holding screws from pressure. A plunger bears against one side of each dog, pressing it toward the work. The dogs have V-shaped teeth cut on a cam circle having a rise of $\frac{1}{32}$ in. in 15 deg. The teeth are about $\frac{1}{16}$ in. deep.



Universal driver for lathes

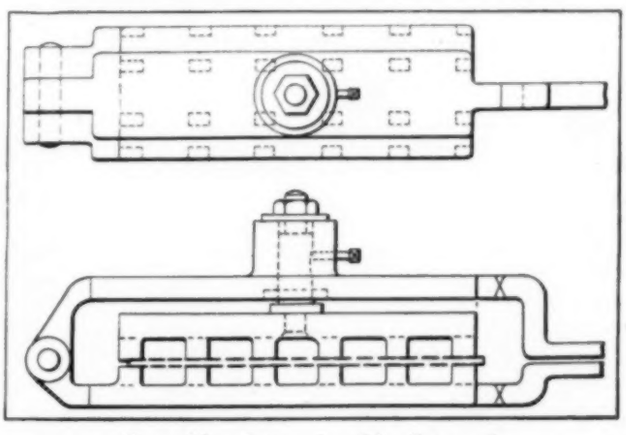
Fixture for Quenching Thin, Flat Stock

By Ernest Foldvary

Thin, flat stock has a tendency to warp in quenching, and to a certain extent in heating. If the work is not ground after hardening, the percentage of scrap due to warpage is relatively high. If the work is to be ground, any warpage necessitates the allowance of more stock than if the work were flat, especially if the stock is thin. Warped stock is difficult to hold on the magnetic chuck on account of the uneven surface.

The simple fixture shown in the illustration prevents warpage in quenching, and if any warpage develops in heating, it presses the work flat before it is quenched. The fixture can be used for quenching such work as shims, weir plates, washers, rings and so forth, and has adjustment for different thicknesses of work.

The lower part is provided with square rest-pads, the size of which depends on the size of the average work to be handled, but the height should not be less than $\frac{1}{2}$ in. to allow the quenching medium to flow around the work.



Quenching fixture for thin, flat work

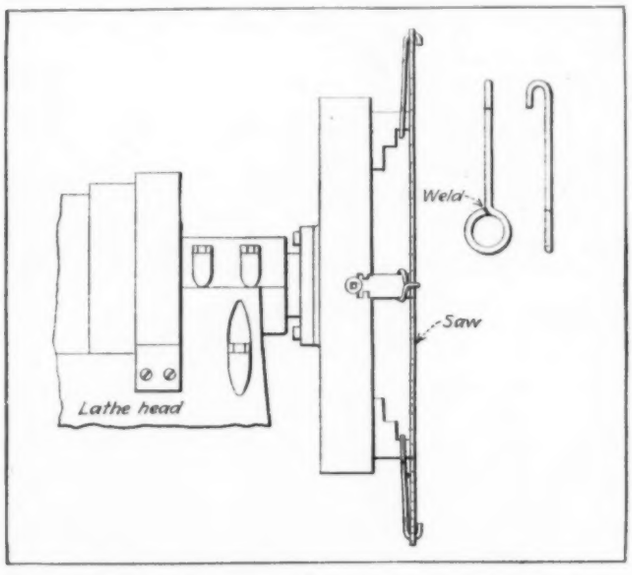
The upper part has an adjustable pad to take care of work of different thicknesses. Long handles welded to both the upper and lower parts enable the quencher to move the fixture about in the quenching medium.

In operation, the furnace man places the heated work into the open fixture. The man who does the quenching immediately closes the fixture and dips it into the quenching bath. If the operation is done quickly, but little heat is lost.

Increasing the Capacity of a Chuck

By H. M. James
James Machine Works, Monroe, La.

A customer sent us a lot of circular saws, 36 in. in diameter, to have the center hole bored out. The largest lathe in the shop would swing the saws, but the chuck



Extension hooks used to increase the capacity of a lathe chuck

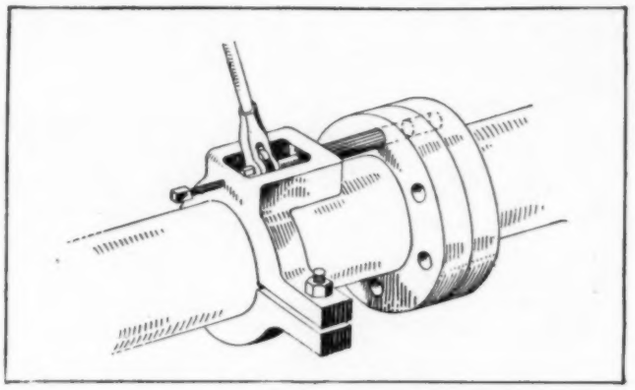
jaws would not reach to the outside. We were about to "pass up" the job, when the foreman came to the rescue by suggesting the extension hooks shown in the illustration. By using these hooks we found it as easy to handle the saws as it would have been with the regular chuck jaws.

Fixture for Reaming Bolt Holes in Coupling Flanges

By K. Takashaki
Kamatamachi, Japan

When large shafts are coupled together through flanges that are integral parts of them, the bolt holes can be drilled in each flange separately, providing care is used in doing the work. However, where the bolts are to be a tight fit in the holes, the holes must be reamed through two abutting flanges at the same time. Such work is generally done by hand, because, if it were done by machine, the machine would have to be equipped with a very long and slender spindle.

The illustration shows a fixture by which the reaming can be accurately done by hand. In the device, as shown, the reamer is rotated by means of a ratchet wrench, being



Reaming fixture for coupling flanges

guided through a hole in the end of the bracket. Feeding is accomplished by turning the long screw at the left.

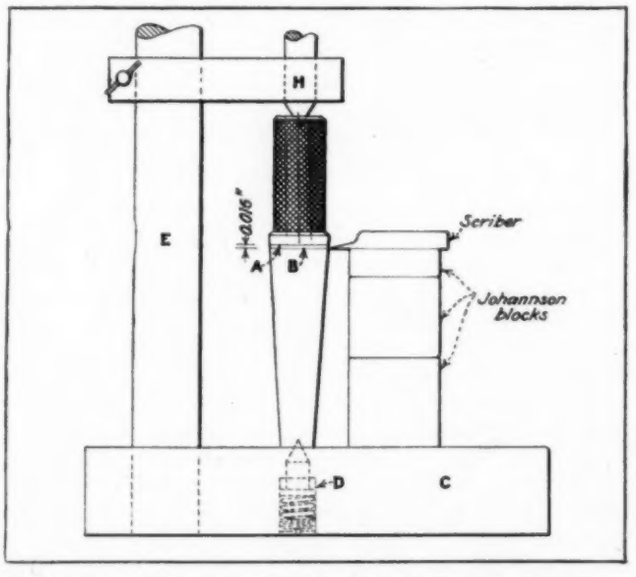
After one hole has been reamed, the reamer is withdrawn and the clamp screws holding the fixture on the shaft are loosened. The fixture is then rotated until the reamer comes fair with the next hole, when the clamp screws are tightened and the work goes on as before.

Fixture for Scribing Taper Plugs

By Gus. Haessler

While employed in the gage and tool department of an automobile plant, I had occasion to scribe the limit lines *A* and *B* on some taper plug gages, preparatory to etching them.

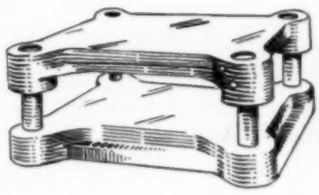
The fixture used for holding the gages during the scribing operation is shown in the illustration. It consists of a cast-iron base *C* which is bored and counterbored for the spring center *D*, and drilled and reamed for a drive fit with the vertical shaft *E*. The upper center *H* is adjustable and held by a clamping screw *J*.



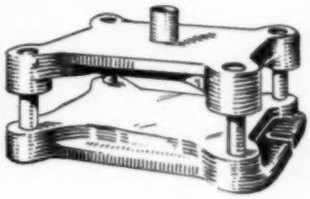
Using Johanson gages to scribe limit lines on taper plugs

The stiff spring under the bottom center allows the gage to revolve freely and accurately on the base *C*. Johanson blocks are used for measuring. The active working surface of the gage is painted to protect it from the etching acid and rough handling.

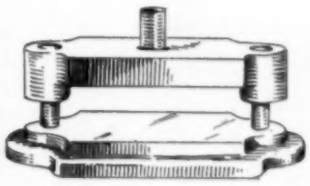
Typical Die Sets



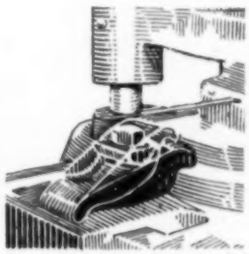
Four Leader Pin Flange Die Sets



Four Leader Pin Die Sets



Flange Center Leader Pin Die Sets



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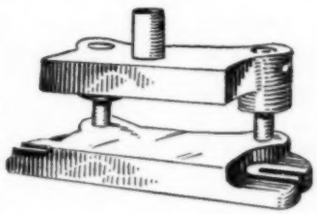

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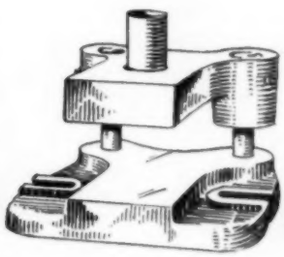

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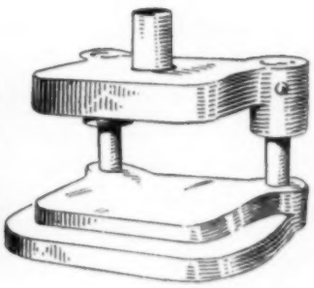

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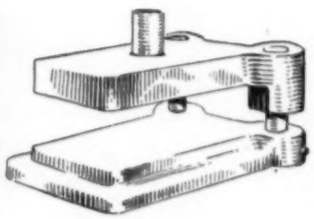

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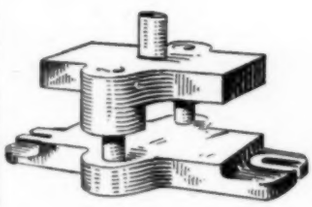
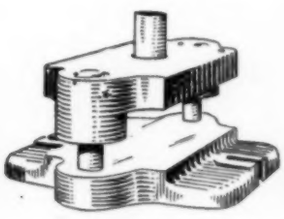


Center Leader Pin Die Sets



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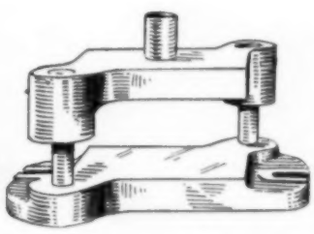

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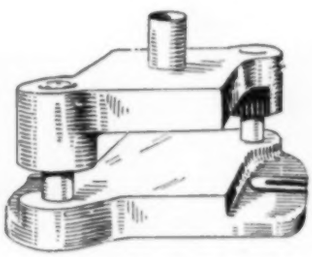

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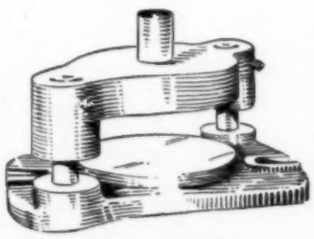
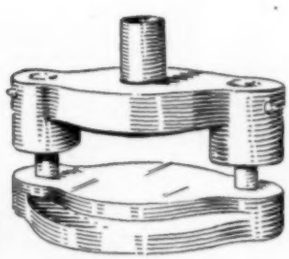
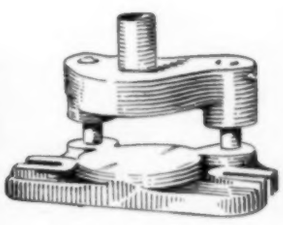


Round-Base Staggered Leader Pin Die Sets



Round-Flange Leader Pin Die Sets



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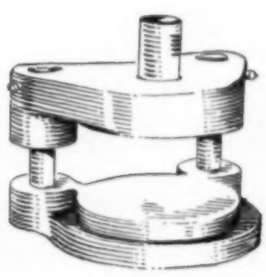

Round-Flange Back Leader Pin Die Sets

Courtesy E. A. Baumbach Manufacturing Company

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Pushing Work Through Too Fast Is Poor Economy

WHAT is probably an inevitable catastrophe is overtaking the machinery industry. Men that have been working under pressure for many months, because of the high rate of activity in the industry, are getting stale and their workmanship is showing the result of their mental and physical condition. Machines that are not right and that should never have been shipped are reaching customers, and are being received with anything but a friendly welcome.

One buyer reports receiving machines from five different builders, all of them famous for the quality of their product, which failed to operate properly when set up. Two of the machines were so bad that they had to be sent back. Others were rebuilt on the job, and the expenses of trouble men were enough to absorb all of the profit on the sales.

Bad as this situation is—nobody likes to lose the profit on a sale because of poor work in his own shop—it represents but a minor phase of the real evil. How long will it take the builder of the faulty equipment to live down the bad impression made on his customers, to regain the reputation that he had before? News of this sort spreads rapidly, unfortunately.

It is admittedly a great temptation to rush work out when the customer is clamoring for it, and has already waited long, but it is a temptation that, if yielded to, may easily lead to a downfall of reputation as lurid as any ever staged in a "ten-twent-thirt." And when that reputation is gone, the door is wide open for the sheriff.

Dramatizing the Shop

MANY of the worries that afflict shop executives can be traced straight back to a lack of knowledge or to a misunderstanding on the part of some one down the line. Some of the men at the bench or machine have had little education and cannot be expected to realize what it means to wreck an expensive piece of production equipment or ruin an intricate part of the product.

Admonitions and instruction sheets may help but it usually takes something stronger, more dramatic, to get the desired comprehension. In one shop spoiled work, even though some of it could be salvaged, is saved up until it constitutes a heap of imposing proportions, and then the entire force is gathered together for a ceremonial destruction of the whole lot. There is no man so stupid or careless that he will fail to be impressed by such a demonstration.

In another shop the cost of each piece of equipment, and the date of its acquisition, are clearly marked on the machine so that the worker has constantly before him a reminder that he is responsible for a five- or ten- or twenty-thousand dollar tool. The result is that no equipment has been ruined by carelessness since the markings were put on.

In this day, when every one sees movies and listens to radio, it takes something more or less dramatic to fix his attention on everyday matters.

How Shall We Lubricate?

LUBRICATION is an acknowledged necessity for all bearing surfaces. In some few instances it is possible to so impregnate bearings with lead, graphite, or other materials, that they will run without additional lubrication. In the great majority of bearings, however, it is necessary to introduce lubricant at more or less regular intervals to reduce wear, as well as to prevent frictional heat and the complications that ensue. But, while there is general agreement as to the need of lubrication, there is a wide divergence of opinion as to how it is to be accomplished.

The open oil hole and the squirt can have few friends. But the advocates of individual oil cups, of oil reservoirs with gravity leads to bearings, of pressure oil pumps or of pressure grease guns, are in open and vigorous dispute. Men of wide experience are divided, both as to the best method of getting lubricant to the bearing and as to who should be responsible for it. Sight feed oilers that can be seen by the foremen have vigorous advocates. A system that will positively force lubricant to a bearing and so replace the old oil or grease with new is equally popular. Both methods are in use with apparent success. It is quite probable that each may have its field. The main thing is to remember that lack of adequate lubrication is responsible for many production delays, and that provision for adequate lubrication is a real problem that must be considered.

Fay 24-Inch Automatic Lathe

WORK up to 24½ in. in diam. can be swung on this 24-in. Fay single-spindle automatic lathe made by the Jones & Lamson Machine Company, Springfield, Vt. The increase in size over the standard Fay automatic, which swings work 14¾ in. in diam., permits additional facilities for mounting tools and attachments, thus making it possible to finish more complicated pieces completely in one setting than is now possible on the smaller type standard machine.

The 24-in. machine is similar in construction to the standard Fay automatic lathe but is heavier, larger and more powerful. It may be equipped for center work, as shown in Figs. 1 and 2 showing front and rear views respectively, or for chuck work as shown in Fig. 3, and is particularly well adapted to the machining of tractor parts, large automobile parts, flywheels, pipe flanges, large ball and roller bearing races, spur and bevel gears as well as the miscellaneous manufacture of machine parts. According to the manufacturer the 24-in. size is easy to set up on simple work so that it can be used to advantage on a variety of parts made in small lots.

A complete line of tools and attachments has been designed for this machine similar to the equipment used on the present standard Fay automatic. These attachments can best be described by outlining the tools and operations used in machining the outer and inner races of large SKF railway-type spherical roller bearings, one of the first applications for these machines. In the first operation the forging is chucked on the inside while tools on the back of the carriage rough-turn the outside diameter and a tool on the back arm rough-faces one end. At the end of the stroke the tools on the carriage also rough and finish the chamfer and radius on the outside and inside of the outer end of the forging. The machine then goes into fast motion, the carriage is rocked forward and the tool on the front of the carriage finish-turns the outside diameter on the return stroke, while the second tool in the back arm finish-faces the outer end and an end-cut tool in the back arm finally finishes the outer radius.

The carriage on this machine is a special carriage equipped with two sets of tools, one in the front slide, the other in the back slide. This carriage was especially developed for this machine and in combination makes it possible to take roughing and finishing cuts all over on the average class of work such as flywheels, gears and various forgings.

In the second operation on this piece, Fig. 4, the inside diameter of the race is machined on a sphere. The carriage used for this purpose is equipped with a double control former, the former slide having two positions, one of which is used for rough profiling the inside spherical diameter with a tool on the front of the carriage, the other being used for finish-profiling the inside diameter with a tool on the back of the carriage. On this second operation almost an inch of stock is removed on a side of the bore. The forgings are about 14 in. in diam. and about 5 in. wide. The material is very tough ball bearing steel which can be rough machined at only about 40 ft. per min. These forgings, however, are roughed and finished all over in about 12 min. for each operation.

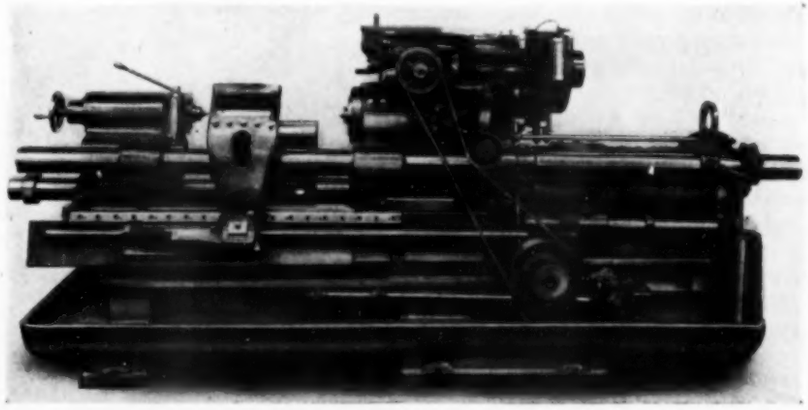


Fig. 2—Rear view of the center-type Fay Automattic Lathe showing the back bar extending the entire length of the machine

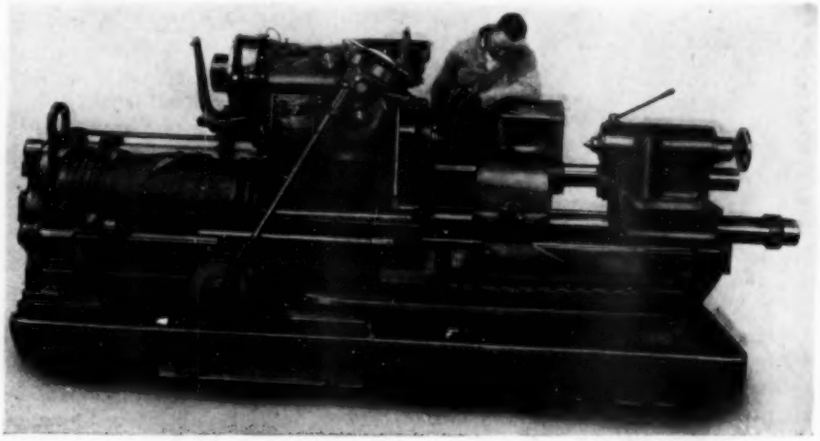


Fig. 1—Front view of the center-type 24-Inch Fay Automatic Lathe

In Fig. 5 is shown the tooling used on the second operation on the inner race of the same railway type bearing. The taper hole has been rough- and finish-bored and one end of the piece has been finished on a previous operation on another 24-in. Fay automatic lathe. On the operation shown in Fig. 5 the piece is held by the hole on an air-operated fixture. The tools in the front of the carriage rough-turn the various steps on the outside diameter, while the back arm is rough-facing the

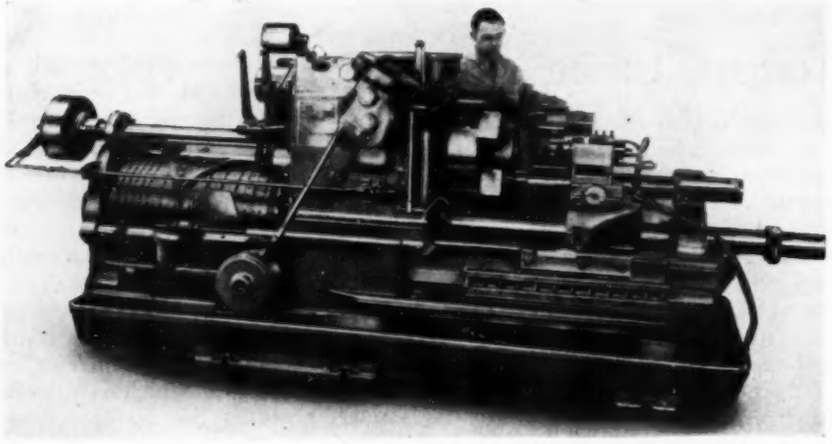


Fig. 3—Front view of the chucking type 24-Inch Fay Automatic Lathe

outer end. The carriage is then rocked forward so that the three tools shown in the back of the carriage may finish turn each of the three lands on the outside of the piece on the return stroke of the carriage. During this time the back arm finish-forms the two large raceways with the two 5-in. diameter circular form tools shown just above the fixture. Simultaneously the tools in the overhead slide face the undercuts on the flanges adjacent to the raceways. Another tool in the back arm also finish-faces the end of the piece during this same time. Additional tools in the carriage in the meantime have roughed and finished the chamfers on the end of the hole and outside of the piece.

This operation illustrates the large number of tools that it is possible to bring into action at the same time on this improved type of machine and indicates the heavy cuts that may be taken on this class of work. This large piece also is made of tough ball bearing steel and the operation described is completed in about 12 minutes.

The machine shown in Fig. 1 has a length of bed that will take work up to 24 in. on centers. The tailstock ram is 6 in. in diam. and carries a heavy-duty revolving tailstock spindle mounted on special precision-type ball bearings. The tailstock ram may be either lever operated or screw operated. A flange 11 in. in diam. with a taper pilot is provided on the headstock spindle, and fixtures, chucks and face plates are mounted in such a way that they can be bolted to the outer section of this flange and located by a tight draw fit on the taper pilot. The cam drum on the machine is 18 in. in diam. and thick, hardened steel cams are used on both the inside and outside of the drum. The center bar and back bar are 4½ in. in diam. and extend the whole length of the machine, providing rigidity to both the carriage and the back arm. An automatic speed-shift mechanism which changes the spindle speeds automatically during the operation of the machine may be provided on the headstock, or it may be equipped with a sliding-gear type of transmission, in which case the spindle wheels are set by hand before the machine is started. The type of transmission used is determined by the class of work on which the machine is to be applied and by the production requirements.

The machine shown in Fig. 1 is approximately 10 ft. long overall, and 4 ft. wide. It weighs about 14,000 lb., crated for shipment.

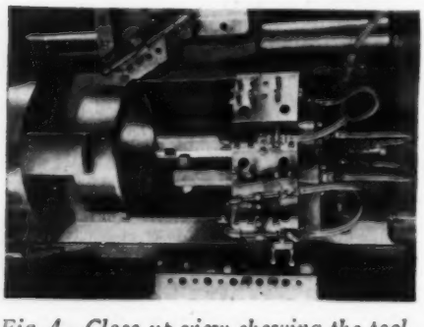


Fig. 4—Close-up view showing the tooling arrangement for finish-turning large roller bearing outer races

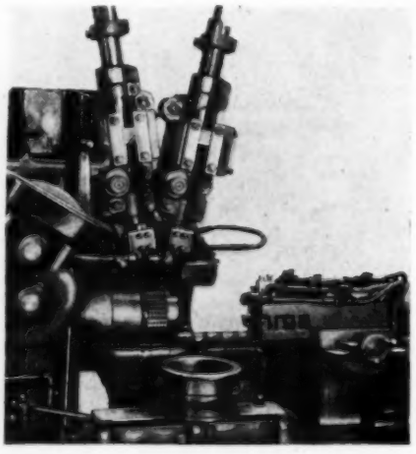
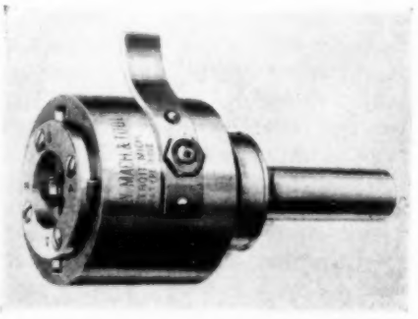


Fig. 5—Set-up for turning spherical roller bearing inner races

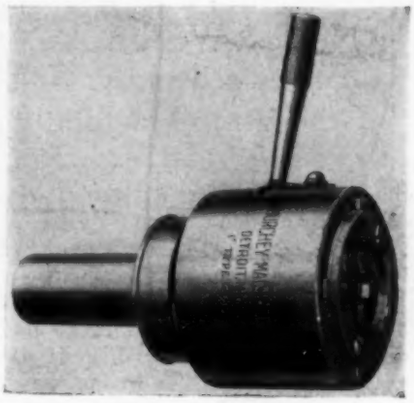
Murchey Types P and G Screw-Machine Dieheads

The type "P" non-rotating diehead, designed by the Murchey Machine & Tool Company, Detroit, Mich., is principally for use with the Nos. 0 and 2 Brown & Sharpe automatic screw machines. The chasers used are interchangeable on both types and on types "O" and "CO" dieheads, making only one set necessary for both spindle and turret work.



Murchey Type P Non-Rotating, Self-Opening Diehead for B & S Automatic Screw Machines

Both the types P and G dieheads are arranged to close with a cam, by a rotary motion of the shell actuated by the closing arm, which engages a trip on the bed of the machine. It is adjustable for thread length and opens automatically when the thread is cut. The trip for doing this is self-contained and acts instantaneously, thus insuring a straight thread. This "snappy" trip is the outstanding feature of the type P diehead, and makes it particularly adapted to short threads such as are usually cut on B & S screw machines. Another feature is that it is possible to remove the chasers without taking off the cap. The stop collar is removed, the



Murchey Type G Non-Rotating, Self-Opening Diehead for turret lathes and chucking machines

shell slid back, and the chasers removed. They are replaced just as easily. This is true also of type G.

The type P diehead will be manufactured in $\frac{7}{16}$-, $\frac{9}{16}$-, and 1-in. sizes only. The type G will be made in the same sizes and also in $1\frac{1}{4}$-, $1\frac{1}{2}$-, and 2-in. sizes and in $\frac{1}{2}$-in. steps up to 5 in.

Both types are adapted to any non-rotating single-spindle automatic threading machine, due to the fact that they are instantaneous in action, small in diameter, and true precision tools.

Carborundum Lapping Compounds

Twenty-two grades of finishing compound for the lapping of gears, bearings, and other mechanical moving parts have recently been introduced by the Carborundum Company of Niagara Falls, N. Y. Carborundum (silicon carbide) and Aloxite (fused alumina) are the manufacturing abrasives used, the former for the finishing of hardened metals, particularly gears, and the latter for the lapping and finishing of softer metals. The abrasive grains are accurately graded to size and in minute powders, and classification is carried out under microscopic control. The carrier medium used is a special compound having the characteristics of a mixture of oil, grease and water.

The advantages claimed for the carrier medium are that it is unaffected by temperature changes, holds the abrasive grain in unchangeable suspension, provides cool cutting action and high speed of cut and still prevents grain marks showing, is non-flowing, non-dripping and non-corrosive, will not affect the operator's skin, and finally, does not require the use of a cleaner that is explosive.

Advantages claimed from the use of Carborundum-brand finishing compounds are that bearings lapped with them present from 75 to 90 per cent metal-to-metal contact, and that the lapping time is from one-fourth to one-half less than that required by the scraping process.

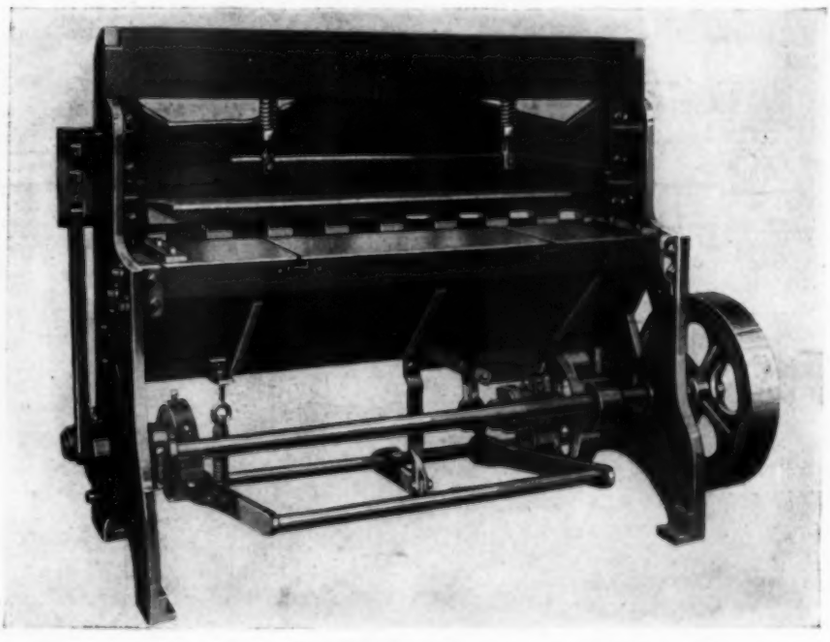
For the lapping of split bearings of bronze or babbitt, Carborundum-brand finishing compound of the grade known as HR2-40 is recommended, to be followed by the use of AF2-40 if a particularly fine finish is required. In the lapping of solid bearings of bronze or babbitt, a finer grade is recommended, either HT2-40 or HX2-40, the latter for use where the fit is very close. Kerosene is the cleaning medium recommended.

"Chicago" 14-Gage All-Steel Squaring Shear

TO ITS line of all-steel brakes and presses, the Dreis & Krump Manufacturing Company, 74th St. and Loomis Blvd., Chicago, has added a light and a heavy type under-drive squaring shear. The lighter type shear, illustrated, differs from the heavier one with regard to the driving mechanism, having a two-shaft drive with positive quick-acting jaw-type clutch, instead of a three-shaft drive with friction clutch, as in the heavier model.

When the treadle is fully depressed, the upper knife bar makes one complete stroke and stops at the highest point unless the treadle is held depressed, in which case the upper knife bar is kept in continuous motion. Unless it is desired to keep the upper bar in motion, it is not necessary to hold the treadle depressed while the shearing operation is performed. Provisions are made so that the clutch cannot engage unless the treadle is fully depressed. Tool steel facings are used in the clutch jaws to insure long wear, and they can be easily replaced if necessary.

These shears are of the steel plate welded construction featured on the line of press brakes made by this company and are practically unbreakable and are very rigid. In both types of shears, also, the "Super-Uniform" pressure hold-down is used, assuring a uniform amount of pressure on the metal before the cutting operation is started, and during the entire stroke. Complete guarding is used on the front, rear, and sides of the shear,



"Chicago" 14-Gage All-Steel Squaring Shear

covering all the mechanism, and keeping it free from dirt, scale, and entanglement with scrap and trimmings.

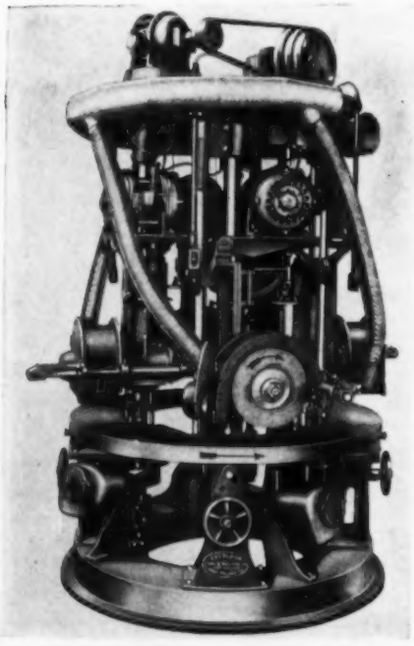
Timken roller bearings are used in the flywheel shaft to insure ease of operation and saving of time. Standard equipment also includes a centralized system of lubrication operated with a hand plunger, which oils the slides and bearings with the exception of Timken roller bearings which require separate greasing, and also with exception of the clutch.

The light machine shown is primarily designed for cutting 14 gage sheet in 3- to 12-ft. widths, and shorter widths of 10-gage and $\frac{3}{16}$-in. material. They are especially adapted for factories where speed is essential in cutting the lighter gages.

Excelsior No. 26 Automatic Four-Wheel Grinding and Polishing Machine

FOR rough grinding, polishing, or buffing flat or semi-flat articles, such as castings, forgings, stampings, sheet metal parts, and similar work, the Excelsior Tool & Machine Company, East St. Louis, Ill., has introduced a new four-wheel grinding and polishing machine. The work is placed on suitable containers or on a magnetic chuck on the revolving feed table. If four wheels are used, the product is inserted and removed at the same station by one operator. If two wheels or one wheel suffice for the finish required, the capacity of the machine is increased to two or four operators.

On each unit the wheel-spindle guard, wheel-truing attachment and belt-tightening device are self-contained and can be adjusted so that the grinding wheel can be set at any angle. The speed of the wheels can be changed from 1,800 to 3,000 r.p.m. by changing the motor pulley. A handwheel adjustment in front of each unit provides for regulating the height from the table to the wheel. The wheels can be raised from the work and automatically locked in their upper position, so that they can be changed without interfering with the production of the machine. Each unit is balanced by adjustable weights to give the desired pressure, and also to make the wheels free to raise if the material to be ground is of uneven thickness.



Excelsior No. 26 Automatic Four-Wheel Grinding and Polishing Machine

Each unit slides on four large upright shafts extending between the upper and lower housings. Long adjustable bearings are provided with supports for the guide bars clamped to the main support shafts. Vibration is thereby practically eliminated.

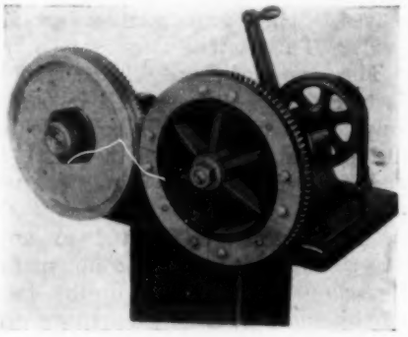
The feed table is driven by internal gear and pinion connected to the worm reducer, which is belt-connected to the motor with three-step cone pulleys for variable speed. The speed is 5, 9, and 13 lineal ft. per min. Motor speed is 900 rev. per minute.

The machine is of dustproof construction throughout, and has an exhaust system for dust removal. Structural steel wheel guards and wheel dressers are furnished when solid grinding wheels are used.

The motors used are 10 hp., 1,800 r.p.m., with dustproof ball bearings, and normally are of a.c. type for use on 3-phase, 60-cycle, 220- or 440-volt circuits. Wheel capacity is 16 in. in diam. by 6-in. face and $1\frac{1}{4}$-in. hole, and the speed can be selected to suit. The size of the machine is: Height overall, 10 ft.; circular feed table diameter 72 in., width 10 in. The weight complete is 12,000 pounds.

Noble & Westbrook Special Rotary Graduating Machine

The special rotary graduating machine shown in the illustration was designed and built by the Noble & Westbrook Manufacturing Company, Hartford, Conn., to graduate a $12\frac{1}{4}$-in. aluminum disk having 400 divisions and numbers at every five divisions. The numbers and the graduation are rolled on in one operation by steel marking dies,-these dies being held in accurate position by specially cut gears. As can be seen in the illustration, these marking dies



Noble & Westbrook Special Rotary Graduating Machine

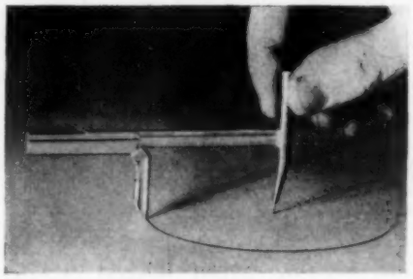
are made in removable sections. These dies are made of special steel, and are mounted on a carrying wheel shown just below the handle.

The disk to be graduated and numbered is attached to the other gear shown. Pressure needed to roll the graduations and numbers on the work is applied through a treadle and a lever carried inside of the column. The machine is operated by a hand crank.

The weight of the machine is 375 pounds, completely equipped.

Esterbrook No. 8 Beam Compass

A low cost beam compass, which keeps both needle and lead parallel and vertical, has been introduced by the Esterbrook Steel Pen Manufacturing Company, Camden, N. J. Because the needle and lead are parallel and vertical, the chance of slipping or enlarging the center points is impossible as happens when the point is on an oblique angle. There are only two



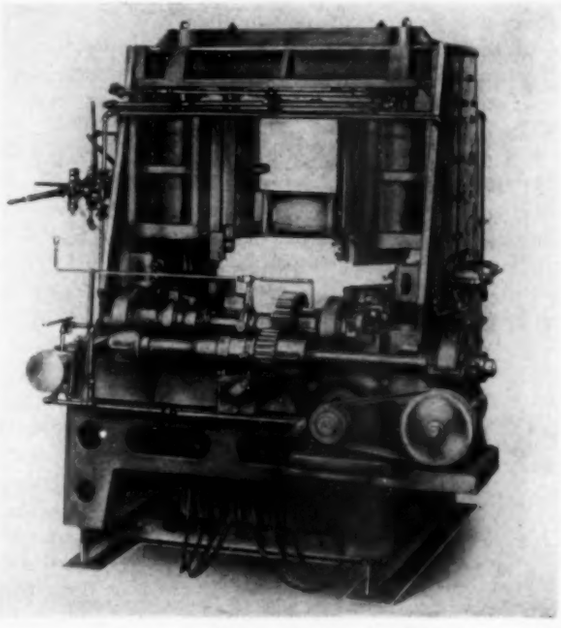
Esterbrook No. 8 Beam Compass

main parts to the compass, the unit post and beam and the slide that holds the lead. According to the manufacturer, there can be no wear of moving parts to cause inaccuracy.

The post and beam are made of a zinc alloy and the slide is of German silver. Both are plated, insuring a bright finish and rustproof quality. The slide is reversible to make circles up to 8 in. in diam. When the slide is reversed for large circles, the radius is exactly 2 in. or 5 cm. longer than the scale reading. The scale readings are in inches on one side and centimeters on the other. A regular compass lead is placed in the holder and it can be re-sharpened at the proper slant without removing the compass. A spring clamp is used to hold the lead tight, and is slid up to release the lead, but will not slide off or become lost.

Thomson Model 502 Cowl Welder

THE Model 502 cowl welder recently introduced by the Thomson Electric Welding Company, Lynn, Mass., is fabricated from heavy steel castings, structural plate, and structural shapes. The four clamping cylinders are operated from a single Oilgear pump. Push-up pressure and movement are obtained from a direct motor-driven cam having a cycle time of 7 sec. The speed reduction between motor and camshaft is obtained by means of a Texrope drive and a standard gear reduction unit. Two identical cams mounted on a common shaft are used for obtaining the push-up movement and pressure because of the width of the machine. The return of the movable platen to open or loading position is by means of two air cylinders. The transformer is rated at 250 kva., and current regulation is obtained through separate autotransformer. For clamping vertical flanges on the outer edges of the cowls, there are four small horizontal clamping cylinders. Special features have been provided for aligning and backing up the clamping dies. Welders of this design can be adapted to various shapes of cowls, and, with minor changes, can also be made suitable for butt-welding wide, thin sheets up to approximately 44 in. in width. The net weight of the machine is approximately 30,000 pounds.



Thomson Model 502 Cowl Welder

Paasche Pressure-Feed Paint Tank

The Paasche Airbrush Company, 1909 Diversey Parkway, Chicago, Ill., is introducing a standard line of stationary pressure paint tanks for automobile and large finishing production. The equipment consists of one-piece, pressed-steel, leaded tanks with full-size covers. The covers are held on by clamps operated by levers. Each clamp is adjustable with washer shims for correct tension and, once set, tightens uniformly. Airmotor agitators, or hand agitators, are available for each size, as desired.

Paasche Pressure-Feed Paint Tank

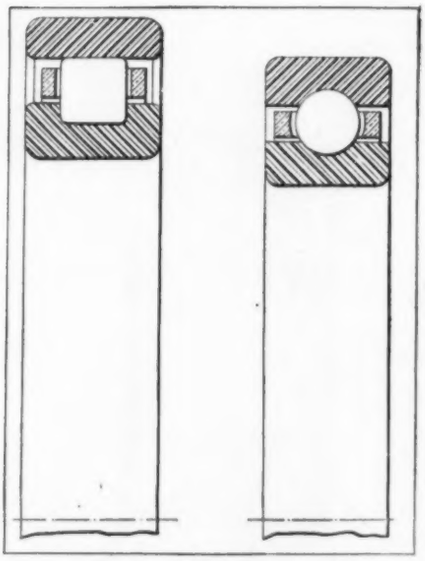
The tanks are made in the following sizes and dimensions: 60 gal., 24 in. high x 36-in. in diam.; 32 gal., 18 in. in diam.; 20 gal. 18-in. in diam.; 12 gal., 12-in. in diam.; 6 gal., 12 in. in diam. Refill tanks of leaded-steel, with cover, are also available.

Norma-Hoffmann Extra-Light Series Ball and Roller Bearings

An extra-light series of ball and roller bearings has been developed by the Norma-Hoffmann Bearings Corporation, Stamford, Conn. These are referred to as the XLS series ball bearings, and the RXLS series roller bearings. The porportions of each are indicated in the illustration.

These ball and roller bearings are made with a very large bore and small outside diameter, so that the section of the bearing is relatively small when compared with its diameter. These bearings were particularly developed for certain types of machine tools where the bearings are mounted on hollow shafts or tubing.

Both types of bearings are supplied with a substantial bronze retainer



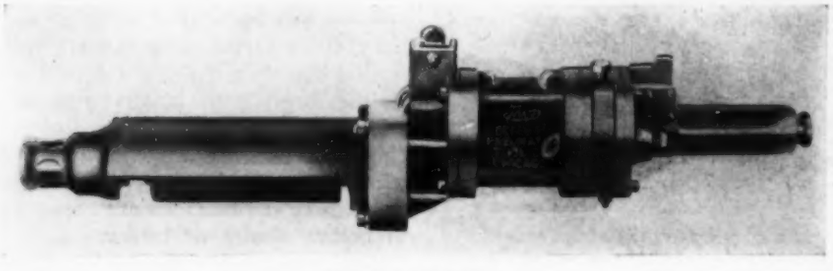
Norma-Hoffmann Extra-Light Series Ball and Roller Bearings

completely machined and electrically riveted. These retainers are carried upon the ground flanges of the inner rings so that the balls or rollers are relieved of the weight of the retainer. Both types of bearings are made in inch dimensions and are obtainable in sizes ranging from 1½-in. bore upwards.

"Thor" Pneumatic Rod Grinder

A Rod grinder especially adapted for locomotive work has been placed on the market by the Independent Pneumatic Tool Company, 600 West Jackson Blvd., Chicago, Ill. This powerful grinder is used for surfacing locomotive frame jaws, rods, straps, rod brasses, shoes, and wedges, welds and valve motion parts. The wheel guard is made small enough in diameter to get into a 2¾ in. space. Convenient grips permit holding the machine comfortably.

The unit is available in two wheel lengths, which are 6 and 9 in. The 6-in. size has a speed of 7,000 r.p.m., weighs 21½ lb., and is 26 in. long. It takes an emery wheel 6 in. long by 2½ in. in diam. by ¾-in. hole. The 9-in. size also has a speed of 7,000 r.p.m., but weighs 23¾ lb., and is 29 in. long. This size takes a 9-in. emery wheel 2½ in. in diam. by ¾-in. hole.



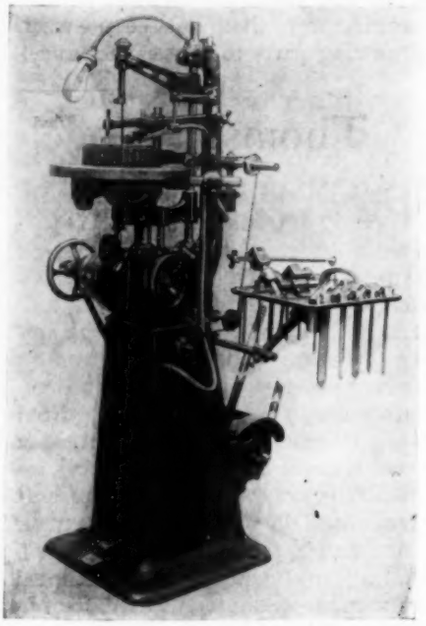
"Thor" Rod Grinder

"Thiel" Precision Die Filing and Sawing Machine

MARBURG Brothers, Inc., 90 West St., New York, N. Y., are offering an improved type of "Thiel" precision die filing and sawing machine. In the new machine the column has been entirely inclosed making the machine more rigid, and the table support has been improved and strengthened. The machines are used for operations such as sawing out or finishing small irregular holes, and are adapted for making jigs, templets, cams, punches and dies of all kinds, forming and drawing tools, and for other work demanding accurate sawing and filing, and which would otherwise require profile planing, slotting, broaching and milling operations.

The machines come in three standard sizes known as sizes 2, 3 and 5. The first two sizes are for small and medium-size work, and the last size is for extra large work.

Lower and upper arms, which support files and saws, are mounted on a spindle rigidly held by bushings above and below the work table, thus insuring perfect guidance of files and saws, greater accuracy in filing, and more accurate and rapid sawing. The upper arm can be set as desired, permitting the shortening and lengthening of the holding frame formed by the two arms and a part of the spindle. The machine is thus adapted for saws of a size from jewelers' saws up to ⅜ in. in width, and for files in thickness from about $\frac{1}{64}$ in. up to ½ in. in the case of the Nos. 2 and 3 machines, making them available for a large range of work. Thin files are held like saw blades, under tension. The larger files are held under pressure in ring-shaped holders which permit of quick exchange. Saws are of two distinctly different shapes, short lengths and coils. The former type saws are held in the same holder as the files, while the coils are held in magazines furnished with the machine. Saw breakage is avoided by the use of guides above and below. The table is easily raised and lowered and can be tilted up to 15 deg. in four directions, so that filing or sawing may be done on a taper in any direction and corners finished accurately. The close adjustment possible permits very small relieving angles on dies.



"Thiel" Precision Die Filing and Sawing Machine

Adjustable holders retain the work on the table, at the same time permitting it to move in accordance with pressure exerted by the automatic feeding device, or by hand. The stroke of the machine can be adapted to the thickness of the blank and the length of files and saws used.

With the exception of the smallest size, these machines are equipped with a hand-feeding device and also an automatic feed. The latter is op-

erated by a weight suspended in the column which pulls the work toward the file or saw. The work can be held under the influence of this feeding device either permanently, or during the downstroke only, the latter being of advantage with heavy saws since they can clear themselves during the upstroke.

The chips produced are blown away by an air current. The compressed air is furnished by a small cylinder-type air pump attached to the pedestal of the machine.

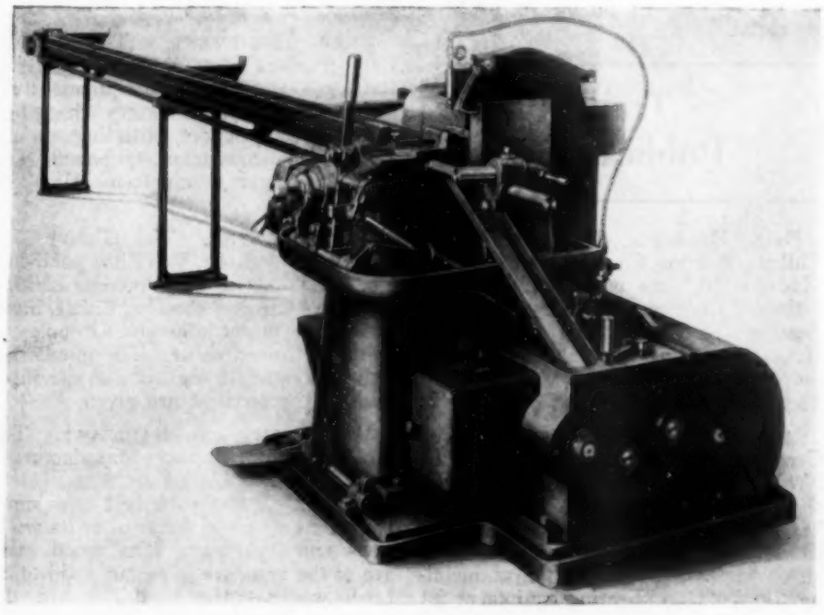
A small mirror attached to the machine permits of illuminating internal surfaces and watching the progress of the work at the points not visible.

The reciprocating parts of the machine are balanced by a spring so that the machines operate without vibration. There is provision for four speeds which makes the machines suitable for a very large range of work. The smallest size admits work up to a thickness of about 2 in. and the largest size to a thickness of fully 5 in. Machines are supplied either for drive from a lineshaft or for individual motor drive. Power requirements are: Size 2, ⅓ hp., Size 3, ½ hp., Size 5, 1 hp. The weights of the motor-driven types of machines are: 395, 590 and 870 lb., respectively.

Cochrane-Bly Automatic High-Speed Cutoff Saw

BRASS, copper, and aluminum bar and tubing may be cut to length automatically on the high-speed cutoff saw illustrated* below and announced by the Cochrane-Bly Company, Rochester, N. Y. The machine will also cut hard rubber, Bakelite, and wood strip. It has a power stock feed and automatic clamping vise and trip. Capacity to cut 2-in. copper bar, 3-in. brass bar, 4-in. brass or copper tube, and also flat bars and extruded shapes is provided in the unit.

The movement of the saw carriage is adjustable from ½ to 4¼ in., and the speed is variable from 5 to 50 strokes per min. with standard speed gearing. Provision is made for much faster operation on small special work. The saw carriage is mounted on dovetailed ways and it is provided with adjustable taper gibs to compensate for wear. A heat-treated spindle mounted in dustproof Timken roller bearings is used. Drive from the motor is positive by means of a silent chain having an idler sprocket to absorb slack and compensate for variation of centers due to carriage movement. Motors furnished are of the constant, variable, or multiple-speed types, and can be used to provide the best cutting speeds for various materials. According to the manufacturer, it is possible to use a highly tempered blade and thereby obtain smooth cuts and high speed.



Cochrane-Bly Automatic High-Speed Cutoff Saw

C M & T Gear Burnishing Machine

Uniformity of pressure applied to the gears while being burnished is one of the principal features of the gear burnishing machine designed and built by the City Machine & Tool Works, 1517 East Third St., Dayton, Ohio. This machine was originally developed for automotive work but is now offered for general application. Other advantages of the machine cited are increase in accuracy of the gear cut, decrease in set-up time, increase in speed and a minimum of floor space. Fig. 1 shows the complete machine, while Fig. 2 shows a close-up of the

Fig. 1—C M & T Gear Burnishing Machine

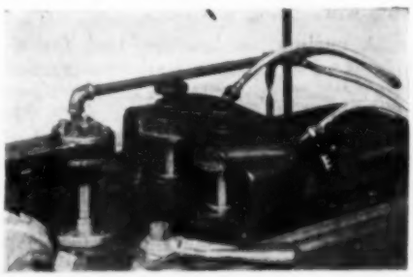


Fig. 2—Close-up of the Gear Burnishing Machine showing the work spindle and the two burnishing gear spindles

three spindles, one work spindle and two burnishing spindles.

The movement of the member carrying the two burnishing spindles and gears is controlled by an air cylinder shown to the right in Fig. 1, which in turn is controlled by the valve shown at the left. Pressure applied is registered constantly on a dial gage so that it can be checked at a glance by the operator. In this way uniformity of pressure is assured with a consequent uniformity of finish.

As can be noted the gears are burnished with the center line in a vertical position, thus insuring straight bearing on gears of any weight or length. Gears of various lengths or diameters are accommodated by moving the supporting member up or down or sidewise by means of hard-knobs shown on the side view. The production quoted is 2,300 to 3,000 gears of 6-8 pitch, varying from 16 to 30 teeth, burnished in a 9-hour day.

REVIEW · OF · RECENT · PATENTS

Relating to the Machinery and Metal Products Industries

Parts and Mechanisms

The Black & Decker Manufacturing Co. has been assigned a patent, 1,702,245, on an electrical connection for its portable tools, a feature of which is its accessibility.

A universal joint was patented, 1,702,363, and assigned to the Almetal Universal Joint Co. It features ample provision for holding and distributing the lubricant in the parts.

The O. K. Tool Co., Inc. was assigned patent 1,702,485 on an adjustable counterbore in which the cutting blades are inserted in slots and held in by taper gibs.

The Geometric Tool Co. was assigned patent 1,702,492 on a self-opening die-head having a cam for moving the chasers positively in either direction. The tripping means is located within the head in a position to be operated by the work being threaded.

A curling, or beading, tool for the plates of automobile body construction, was patented, 1,703,618, and assigned to the Hudson Motor Car Co. The tool has a die and a hook, which operate on the edge of the plate for bending it.

A blowpipe patent, 1,703,750, was assigned to the Torchparts Gas Appliance Co. The nozzle portion is threaded onto the head, and the seating surfaces are frustrated cones with passages provided for preheating the gases.

Materials

Three patents, 1,705,493, 1,705,495, and 1,705,497 were assigned to John S. Stokes, of Huntingdon Valley Post Office, Pa., on molding compounds made from phenol and furfural. Another patent, 1,705,493, covered a synthetic molding resin made from phenol and a polyhydric alcohol.

A weatherproof laminated plate glass was patented, 1,705,631, and assigned to the Indestructo Glass Corporation. The organic molded sheet between the layers of glass is protected on the edges by a filler of linseed oil, rosin, and wax.

A process for making a grinding and polishing powder, patented, 1,704,308, by Bertrand Szilard, of Paris, France, consists in the steps for making the powder from titanium oxide and another titanium salt.

A synthetic molding product patented, 1,704,347, and assigned to the Edward G. Budd Manufacturing Co., consists of a condensation resin made by reacting urea and formaldehyde and adding thio-urea.

A patent, 1,704,253, on a plastic light aluminum alloy assigned to the Hybinette Patents Corporation covers an aluminum alloy with less than ½ per cent of copper and ½ per cent of magnesium to make it only slightly responsive to heat-treatment. It contains less than 2½ per cent of heavier metals, and the strength is brought out by working the metal.

Trade Publications

BALL BEARINGS, REGROUND. The Ahlberg Bearing Co., 321 East 29th St., Chicago, Ill., has published a catalog entitled "The Story of Ahlberg Ground Bearings." This catalog gives views of the regrinding of used bearings and shows the extent of the service rendered. The catalog is illustrated in color.

INDUSTRIAL HEATING DEVICES. The General Electric Co., Schenectady, N. Y., has published a small folder showing various types of industrial heating devices. These are soldering irons, glue pots, immersion heaters, strip heaters, cartridge units, metal-melting pots, and heating equipment for industrial ovens.

GENERAL ELECTRIC PUBLICATIONS. The General Electric Co., Schenectady, N. Y., has published a series of pamphlets as follows: Bulletin 517B, superseding 517A, on type CD totally-inclosed, fan-cooled d.c. motors from 2 to 51 hp.; Bulletin 750A, superseding 750, on induction frequency converters, types ITT and IQT; Bulletin 1106 which treats of the type CR 7006-F1 magnetic switch, across-the-line starter for induction motors; and Bulletin 1115 shows furnaces for vitreous enameling.

MANNING, MAXWELL & MOORE ORGANIZATION. Manning, Maxwell & Moore, Inc., 100 East 42nd St., New York, N. Y., has published a small bulletin showing the various subsidiary companies and their products. The companies listed are: The Putnam Machine Works, Scurlock Gear Division, Consolidated Ashcroft Hancock Co., Inc., The Shaw Crane Works, American Schaeffer & Budenberg Works, The Hancock Inspirator Works, The Consolidated Valve Works and the Ashcroft Gauge Works.

PRECISION BORING. Société Genevoise d'Instruments de Physique, Geneva, Switzerland, has published a 68-page book in English entitled "Modern Precision Boring," which illustrates the application of its jig borer to various problems of laying out, drilling and boring holes. The catalog shows installations in both European and American shops. The book is being distributed in the United States and Canada by the R. Y. Ferner Co., Investment Bldg., Washington.

SAWS, CIRCULAR. The Huther Bros. Saw Manufacturing Co., Inc., 1190 University Ave., Rochester, N. Y., has published catalog No. 49 showing various types of saws of the circular type, saw filing machinery, grinding machines, and small tools. The catalog contains 107, 7x5-in. pages.

SHOP EQUIPMENT. The Hobart Brothers Co., Troy, Ohio, has published Catalog DM 60 on shop equipment for spray finishing and battery charging; also air compressors, grinding stands, and miscellaneous small equipment. The catalog contains nineteen 11x8½-in. pages.

TURRET LATHE. The Gisholt Machine Co., Madison, Wis., has published No. 2 of a series of pamphlets entitled "Gisholt Express" showing the 2L high-production turret lathe and examples of work performed on it. The number is well illustrated throughout and specifications of the machine are given.

WOOD SAWS AND BANDSAWS. The Huther Brothers Saw Manufacturing Co., Inc., 1190 University Ave., Rochester, N. Y., has published two small pamphlets showing the sizes of its wood saws and bandsaws. The wood saws are of the standard circular, solid-tooth type, whereas the bandsaws are the narrow type.

News of the Week

Welding Society Holds Annual Meeting

SEVERAL interesting papers on the welding of corrosion-resistant metals were presented at the annual meeting of the American Welding Society, held April 24 and 26 in New York City. Several of these papers will be published in abstract form in an early issue of the *American Machinist*.

At the first session on April 24 a symposium on the organization and operation of industrial welding schools was held. Among the speakers were C. E. Conway, educational director, Bedford Branch Y.M.C.A.; R. K. Randall, Cleveland Welding School, L. S. Thurston, General Electric Co.; F. E. Sellman, consulting engineer, Servel, Inc.; F. E. Rogers, Air Reduction Sales Co.; R. B. Lincoln, manufacturing engineer, Westinghouse Electric & Manufacturing Co.; and C. A. Prosser, of the William Hood Dunwoody Industrial Institute. In the discussion that followed it was brought out that the ability to train and qualify welders has in many cases been the limiting factor in the application of welding. Many of those present reported it more satisfactory to start with green men rather than men that had some sort of experience in welding. It was also brought out that the chief qualification of a welder is trustworthiness and that this characteristic should have the greatest weight in the selection of welders for the schools.

WELDING CORROSION-RESISTANT ALLOYS

The welding of corrosion-resistant metals was brought out in a symposium on welding in the chemical and process industries. Among those presenting papers were W. N. Dunlap, of the Aluminum Company of America; N. B. Pilling of the International Nickel Co.; T. McLean Jasper, of A. O. Smith Corporation; A. G. Wikoff, of the Carbide and Chemical Corporation, and P. D. Schenck, president of the Durion Co., Inc.

In a paper on "The Strength of Butt Welds," by G. Lobo, Jr. reseach engineer, Westinghouse Electric & Manufacturing Co., it was brought out that 45 deg. is the best angle of bevel for a joint, the strength decreasing with the angle, also that a single V joint is stronger than a double V, and that the strength of the welded joint increases as the thickness of plate is increased up to 1 in. in thickness.

At the business meeting F. T. Llewellyn was re-elected president, and A. E. Gaynor re-elected senior vice-president. Four directors at large were elected, C. A. Adams, H. M. Hobart, A. G. Oehler and J. W. Owens.

At the meeting the Samuel Wylie Miller medal was awarded for both 1927 and 1928. The first award was made to Prof. Comfort Adams of Harvard, past president of the American Institute of Electrical Engineers and a leading figure in the American Welding Society, being its first president. The 1928 award was given to James Harvey Edwards, chief engineer of the American Bridge Co., for his development of structual steel welding.

Hoover Receives Fritz Medal From Engineers

The John Fritz Gold Medal for 1929, the highest honor bestowed by the American Societies of Civil, Mining, Mechanical, and Electrical Engineers, was conferred on President Hoover on April 25, for "notable scientific and industrial achievement as an engineer, scholar, organizer of relief, and public servant." Dean Dexter S. Kimball of Cornell University, presided at the presentation ceremony and gave a brief history of the medal which has been awarded in past years to J. J. Carty, Elmer A. Sperry, Edward Dean Adams, John F. Stevens, Ambrose Swasey, Guglielmo Marconi, Eugene Schneider, Sir Robert A. Hadfield, Orville Wright, George W. Goethals, J. Waldo Smith, Elihu Thomson, Thomas A. Edison, and Alexander Graham Bell. President Hoover's work as an engineer was extolled by Dr. John R. Freeman, past president of the American Society of Civil Engineers and the American Society of Mechanical Engineers.

Woodworking Machinery Survey Started

In co-operation with the National Association of Woodturners, the Commerce Department has gotten under way with its survey and rating of the mechanical equipment of the industry. As the first phase of the work, the lathes used for turning handles are being studied. In compiling the information the lathes are divided into ten groups, classified under a list of forty-five types.

Each lathe will be classified further as to the manufacturer, group, type number, range, floor space, type of drive, type of bearings, feeds, speeds, horsepower required, and capacity production. Information regarding their products has been requested from forty-five manufacturers of lathes. Requests for information also have been sent to fifty wood handle manufacturers.

After some of the results of the survey are tabulated, it is stated that it will be possible for the individual members of the woodturning industry to rate themselves in comparison with the highest possible development. A study of the lathes used in turning furniture parts is expected to be made when the handle turning survey is completed. Later, it is expected that novelty turning, spool, and dowel lathes will be studied and rated.

Engineers Honor Japanese Envoy

On April 24, a group of more than fifty engineers and scientists who form the American Committee of the World Engineering Congress gave a testimonial dinner to the Japanese Ambassador, Katsuje-Debuchi, at Washington and expressed to the ambassador their appreciation of his services in preparation for the Congress which will meet at Tokyo next October. Dr. Elmer A. Sperry, of Brooklyn, chairman of the American Committee of the World Engineering Congress, presided, and John Hays Hammond and Gano Dunn, of New York, also spoke at the dinner.

Simonds Award for Paper on Cost of Distribution

Robert F. Elder, specialist in market research, has been awarded the Alvan T. Simonds award of $1,000 for the best essay on "Reducing the Costs of Distribution" for the year 1928, according to announcement made by the American Management Association, which conducted the competition. Mr. Elder is a graduate of Harvard University and specialist in marketing research for the Brown Company of Berlin, N. H., and Portland, Me. Honorable mention was awarded to Ray M. Hudson, assistant director, Bureau of Standards, Department of Commerce.

Ford Production To Be Speeded Up

Owing to the heavy volume of orders being received, the Ford Motor Co. plans to increase its production during the remaining spring months. During March the output was increased to more than 8,000 cars and trucks a day, and the total March production was 181,894 cars, compared with 125,984 in February. Manufacturing schedules have been balanced to provide for production of the entire line of passenger cars and commercial vehicles. The 6-day factory week which went into effect at

Dearborn on March 1 has helped to build up the production schedules and has permitted the development of an expanded program for the spring and summer months.

Science of Humanics Urged by Foundation

A science of humanics should be built up by research, it is declared in the annual report of the Engineering Foundation, New York. "Experience," says the report, "is showing year after year the actual usefulness and the much greater possibilities of this joint research organization of our four senior national engineering societies with their 60,000 members. Even with small and uncertain resources, many members of these societies on special research committees are making valuable contributions of knowledge for the betterment of engineering and industrial practices.

"Research interests of engineers are not restricted to so-called material things. . . . The engineer's studies must include the effects of his technical activities upon his fellow humans and their social organization."

During the year, according to the report, the Foundation continued its aid to researches concerned with arch dams, concrete arches, steel columns for bridges and buildings, blast furnace slags, electrical insulation, lubrication, engineering education, and painting of wood. It also aided studies of fluid flow, cutting fluids used in cutting metals, engineering vocational selection, and other problems. Two new research projects are now under way. One relates to alloys of iron, and will embrace all forms of irons and steels. The other involves the materials, manufacture, and use of wire ropes.

Following a conference of forty representatives of twenty-nine corporations and other organizations called by the American Institute of Mining and Metallurgical Engineers, a plan for cooperative research in alloys of iron was mapped out. The Institute appointed a Committee on Alloys of Iron Research to serve in an advisory capacity. The chairman is John Johnson, director of research and technology, United States Steel Corporation. "The next steps can be taken as soon as assurance of funds is obtained. From its small resources the Engineering Foundation has appropriated $10,000, besides paying initial expenses.

"Since 1915, the Engineering Foundation's capital funds have grown from $200,000 to $620,000 and its income from less than $10,000 a year to more than $30,000. This small income has been supplemented by cash, services, materials, and facilities, worth in the aggregate several times as much, contributed to projects which the Foundation has aided. An Endowment Committee, appointed by the United States Engineering Society for the Founder Societies, is seeking $5,000,000 for the Engineering Foundation, and $2,000,000 for the Engineering Societies Library.

Cast-Iron Production Still High

Based on a normal production of the average monthly tonnage of good castings for the last three calendar years the production of 98 foundries reporting to the Gray Iron Institute for the month of March was 135.4 per cent of normal. February production was on the basis of 111 per cent. New business received during the month was 135.5 per cent normal and unfilled orders at the close of the month 118 per cent. Of 90 foundries reporting, 50 report conditions good, 37 fair, 3 poor and none bad.

Another index of metal-working activity is given in the report of the Department of Commerce on the production of malleable castings. This shows that the production of malleable castings of the principal manufacturers in March was 88.6 per cent of capacity, as against 77.7 per cent capacity in February and 73.0 per cent in March a year ago. The capacity of each plant is based on the average monthly production for the best six consecutive months since January, 1919. These statistics were reported by 123 firms operating 137 plants, of which 128 were in business continuously throughout the period.

Another index figure given out by the Department of Commerce is that for commercial steel castings. In this case the production was 79 per cent of capacity in March as against 67 per cent in February and 64 per cent in March a year ago. About one-third of this production went into railway specialties.

The fact that gray-iron, malleable iron and steel castings are all enjoying an above normal sales is merely another indication of the tremendous activity in the metal-working field.

Railroad Equipment Orders Increase

Substantial improvement in the railroad equipment market is noted in a report of the American Railway Association issued recently. It shows that freight cars on order on April 1 numbered 42,561, or nearly the total of last year's purchases and comparing with 25,248 on April 1, 1928. On March 1 there were 37,820 freight cars on order.

Locomotives on order on April 1 totaled 372, against 137 a year previously.

French Machinery Trades Hard Hit by German Payments in Kind

THE foreseen handicap which German prestation payments in merchandise was bound to have on the French machinery trades has finally come to the point where it can be no longer ignored, either by French makers themselves or by French importers of American machinery. It is more a question of price than of quality. The selling figure so far as American machinery is concerned is moreover affected by lower transport charges, lesser delivery delays and longer credits than are commonly granted by makers other than those of Germany. The consequence is that French factories are filling up where they can with machinery and tools from across the Rhine on exceedingly favorable terms. With France in the front rank of protectionist countries, this is no inconsiderable factor for the French maker and no less for those importing American machinery and tools.

The Machinery Trades Syndicate in France has come out wholeheartedly for a campaign which it is hoped will put a restraining influence on the growth of the volume of these imports from Germany. The German annuity for the last year under the Dawes plan gave France 1,270,000,000 marks, an increase of 46 per cent over payments of the year before. The transforming metal trades in Germany furnished in kind during 1928 to the value of 225,000,000 francs, which is an increase over the figures of the year before of 252 per cent. The pyramid is still piling up. The exports of the United States to France in 1928 increased but 72 per cent, which is otherwise a satisfactory showing were it not a patent fact that the increase would have been far greater had Germany not been supplying the volume of like goods that she has on reparations account. These German increases were less than 8 million francs per month in the first three months of the year, but rose to 30 million francs per month during the last quarter of 1928. The specific classified figures are lacking for the first two months of 1929, but German exports to France on the whole increased from 682,755,000 francs to 887,000,000 francs in value and from a well considered opinion gathered in the French machinery trade there is no reason to doubt but what the major percentage of increase is to be accredited to machinery and tools.

Such criticism as there may be implied and not directly shown is not that France should refrain from importing, but that her import business in these lines should be fairly divided between the allied and associated nations that are susceptible of catering to the French market, instead of favoring Germany unduly. French imports of such goods show a constant increase, but exports remain practically stable. With this law of trade there is no argument beyond the admission of a natural desire to produce as much as possible for home consumption and still develop an export business.

Latin America Absorbs Much of Our Machinery

By Paul Wooton
Washington Correspondent

Establishment of local industries and the increasing volume of American investments has made Latin America the chief export market for American industrial machinery. In the opinion of specialists at the Department of Commerce this market is certain to increase in importance with each passing year, as practically every one of the southern republics has adopted a high tariff policy. This is certain to build up demand for machinery.

It is believed that the greater proportion of machinery purchases will be made in the United States, as American machinery has come to be looked upon in those countries as the world's best. One of the reasons ascribed for the prestige enjoyed by American machinery is that improvements seem to come first from this country.

Financing in the United States of highway construction and of public works generally is resulting in the purchase of most of the necessary construction machinery in this country. Moreover, American concerns are undertaking public utility enterprises in Latin America. The machinery and equipment for these operations comes almost exclusively from the United States. American supremacy in the manufacture of oil refining equipment, sugar mill, and cement plant machinery is bringing most of the orders for that type of equipment to this country. Just at this time large business is being done in shoe manufacturing machinery.

The decided preference being shown in Latin America for American machinery dates from 1919. While there has been some variation in the demand from year to year, there has been a steady upward climb in the curve of the demand from the southern republics. Mexico during that period has been our best customer, despite its political disturbances. The great bulk of the exports to that country, however, have been mining and oil well machinery. The development of oil in Venezuela has resulted in such large shipments of equipment to that country that it stands in second place. Argentina is third, Brazil is fourth, and Colombia is fifth. In Argentina the demand has been highly diversified. Agricultural machinery has been a large item. In Brazil the principal purchases have been of metal-working machinery and of construction and conveying equipment. In Chile, Peru, and Bolivia the chief demand has been for mining machinery.

Stresses Good English In Engineering Training

Many capable engineers are failing in their profession because of their inability to speak good English, Dr. Harvey N. Davis, new president of Stevens Institute of Technology, said in a recent address before the students of Cooper Union in New York City. The engineering field is clogged by men whose technical training has been thorough, but who, because of their poor spoken and written English, are unable to move up to positions of leadership, Dr. Davis declared. This is unfortunate, because there never was a time when there existed greater confidence in the abilities of the engineering type of mind. Engineers who in addition to their technical knowledge possessed a cultural background have assumed authority in many walks of life and are now captains of business and industry.

A few schools, like Cooper Union and Stevens Institute, are beginning to take very serious cognizance of this problem. Dr. Davis concludes that unless the student is able to make the great effort necessary to rise above his own poor cultural background and make his spoken English, his personality and poise equal to the rest of his mental equipment, he will only add one to the ranks of those who have little prospect in a profession where many possibilities of success exist.

A.S.M.E. Plans Regional Meeting In Rochester

The first meeting of the American Society of Mechanical Engineers to be held in New York State, outside of New York City, since the Buffalo meeting in 1915 is to be held at Rochester, New York, May 13-16. In connection with the meeting for which eleven technical sessions have been planned there will be a wide variety of excursions available. The detailed program, as recently announced by the Society follows:

MONDAY, MAY 13

Morning — Symposium on Boiler Furnace Refractories

Afternoon — Simultaneous Sessions, 2:30

Education and Training

The Technical Institute, European Examples and their Significance to American Education, Wm. E. Wickenden.

Industry Specifies Its School Training Needs, Virgil M. Palmer.

The British Apprenticeship Report and Its Value to American Industry, Wm. S. Conant.

Applied Mechanics

The Calculation of Flywheels for Air Compressors, H. R. Goss and H. V. Putnam.

Vibration Damping, A. L. Kimball.

Evening——Informal Get-Together at home of Miss Kate Gleason.

TUESDAY, May 14

Morning Session—9:30 a.m.

Machine Shop Practice Division

Economies Which may be Effected in Power Transmissions, W. W. Nichols.

Report of an Investigation on Tungsten Carbide Cutting Alloys, W. Paul Eddy, Jr.

Discussion on Wood Industries

Discussion on Applied Mechanics

Teaching of Advanced Mechanics in Universities, S. Timoshenko.

Advanced Mechanics in the Electrical Industry, J. Ormondroyd.

Heat Transmission Discussion

Afternoon — Excursions to Bausch & Lomb Optical Co., and Eastman Kodak Co.

Evening — Dinner, Hotel Sagamore, Speaker Dr. C. E. Kenneth Mees.

WEDNESDAY, MAY 15

Morning — Simultaneous Sessions, 9:30 a.m.

Machine Shop Practice Division

Progress Report on Thread Form of Milled Worms, Earle Buckingham.

Large Spiral Bevel and Hypoid Gears, Allan H. Candee.

Diamonds as Metal-Cutting Tools, Carl L. Bausch.

Materials Handling Session

Power Session

Afternoon — Excursions: Gleason Works, The Todd Co., and Stromberg Carlson Telephone & Manufacturing Co.

Evening — Illustrated Lecture by Prof. C. La Durham, Cornell University: Ancient Roman Aqueducts and Other Engineering Works.

THURSDAY, May 16

Morning — Simultaneous Sessions, 9:30

Management

Controlling the Manufacture of Parts on Order and for Stock by the Gantt Progress Chart, David B. Porter.

The Synchronization of Sales and Production, Howard M. Hubbard.

Mechanical Springs

New Type of Air Spring, J. K. Wood.

Petroleum and Hydraulic Sessions

Research Committee on Effect of Temperatures of Metals

Machine for Making Creep Tests at High Temperatures, G. D. Bagley.

Afternoon — Excursions to General Railway Signal Co., Taylor Instrument Companies, Hickey Freeman and Bastian Brothers.

Appeal for Old Machinery Made by Museum

The Rosenwald Industrial Museum, Chicago, founded as a result of an endowment of $3,000,000 by Julius Rosenwald, is making an appeal for invaluable pieces of apparatus which might find a home in this first industrial museum in America. A large bond issue has been floated by the people of the city for the restoration of the old Fine Arts Building which will be used to permanently house the technical collections. In this museum the history of science, engineering and industry will be interpreted by models, and their social and economic background will be developed and clarified.

The appeal for old pieces of machinery suggested itself when the museum recently learned that a Newcomen engine which stood for many years on the shores of Newark Bay was finally junked because no institution would give it a permanent home. Similarly the big Corliss beam engine that ran the Pullman Works met a like fate. Because the museum believes that it is quite conceivable that there are still in existence many of these technical relics in some inconspicuous corner, this appeal is broadcasted. Communications should be addressed to the Director of the Rosenwald Industrial Museum, 300 West Adams St., Chicago.

BUSINESS BAROMETER . . . *Even the most confirmed optimists agree that business cannot expand indefinitely, and some think that the reaction is overdue*

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

ONE of the wisest of Wall Street's elder statesmen once told the writer that the surest sign of the culmination of a bull market in stocks was an advance in the English bank rate. The infirmity of the market during the nearly three months that have elapsed since that advance took place confirms his wisdom, and if he were alive today he would probably attach almost as much significance to the increases in the rates of the German Reichsbank and the Polish, Hungarian and Austrian central banks that were announced last week.

For these advances serve notice that Europe will not allow her debts to force her off the gold standard again, and that she will maintain her money rates at the figure necessary to keep her gold at home. The corollary is that she will be compelled to do less business, and that our export trade must diminish at the same time that we are being deprived of the inflationary stimulus of the gold import movement that has lately been under way.

If the reparations conferees had been able to reach an agreement, the European crisis might have been postponed and its severity mitigated, but the fact may as well be faced that the absorption of the world's supply of lendable credit has produced a stringency that must eventually compel liquidation of securities and perhaps of merchandise also. Thus "speculative hesitation" is the best description of the conditions that now prevail on the New York Stock Exchange, and the other security markets which dance to the music of the ticker that records the fluctuations on the big board.

When money is to be had buyers are cautions, and when it is scarce sellers are courageous. An occasional burst of strength in some of the speculative favorites is to be noticed from time to time, but those who are in the market seem disinclined to buy more, and those who are out of it show but little disposition to re-enter the speculative arena.

There are other reasons for this than the advance in the foreign bank rates. One is the verbal restraint that the Reserve Board continues to exercise over loans on securities. Another is the prospect that it will take a long time for Congress to agree upon a program of farm relief that will be acceptable to President Hoover. These influences are also commencing to exercise a restraining effect upon trade, and most of the economic bureaus that venture into the field of prophecy are predicting a slight contraction of commercial activity. Even the most confirmed optimists agree that business cannot expand indefinitely, and the best judges of the situation admit that a reaction is overdue.

There is nothing to indicate that this contraction will be acute or unhealthy, for the stocks of merchandise in the hands of American distributors are small, and production is so well under control that it can easily be kept within the limitation of the prospective demand. But it is plain that we are approaching a period of re-adjustment, and that while it lasts dealers will be indisposed to anticipate their prospective requirements. Most of the commodity markets seem to have taken heed of the quieter mood that prevails in the stock market, and a decline has been recorded wherever there was anything to justify it.

In so far as the speculative situation in its entirety is concerned, the money market continues to be the dominating factor, and it seems futile to hope for any revival of enthusiasm until there has been a more substantial reduction in brokers' loans. The attention of the entire country has been so successfully focused upon the credit distention caused by the stock boom, that its psychological influence may perhaps outweigh its technical importance, and it seems idle to hope that securities can be put much higher until the present congestion has been relieved by a partial distribution of the stocks and bonds hypothecated as security for the money that stock brokers are borrowing in order to buy other securities.

Meantime the bond market is commencing to reflect the tightness of money. At present prices the obligations of the United States Government now outstanding are worth about $500,000,000 less than they were when call money ruled at from 4 to 5 per cent and the City of New York has been compelled to announce that it would pay 5¼ per cent on $52,000,000 of subway bonds for which it is now inviting bids.

As the higher rates thus established will tend to restrict municipal borrowing, and delay the completion of many public improvements that have been planned, it is not surprising that building has been reduced, although lately some signs of acceleration have appeared.

In iron and steel it is admitted that new business is now considerably below production and that curtailment will soon be resorted to, although at present the mills are still straining to meet demands for prompt shipment. In the automobile industry reduction of output is likely to begin during May.

Of course a decline in industrial production during the late spring and summer is always expected and it should cause no alarm this year, even if something more than the seasonal recession occurs. Within limits it will be salutary, and nothing could more effectively bring about the reduction in security loans which must precede credit relief.

LITTLE change has taken place in the demand for metal-working tools in the past week, despite the fact that the official figures of the National Machine Tool Builders' Association indicate that a slight let-up was due. Reports coming in from industrial conters show, if anything, a slight rise in volume of orders and inquiries. In the same way, the delivery situation as reported in the various metal-working centers appears to be getting worse rather than better. Production in the machine-tool plants is steadily increasing, despite the complaint of the shortage of skilled labor.

IN THE South, there is a noticeable upward trend in the volume of sales of machinery and machine tools, so that business is now comparable with that of last year. In the early months of 1929, this was the most depressed section of the machinery industry. One of the causes of the present trend is the demand for equipment by textile mills, the heaviest in some years. New England textile machinery builders also are busy at this time and are looking forward to a good year. Detroit reports all branches of the industry booming, with particular emphasis on the automotive and accessory manufacturers. Employment in the city is 70,000 over the number employed in 1928, a record-breaking figure.

GENERAL optimism is expressed as to the railroad situation. While conditions have remained unchanged for the last month in Chicago, in other centers there has been a noticeable increase in the demand for shop equipment. In Canada, railroad buying continues to be the chief factor in the machinery industry there.

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The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CHICAGO

The closing days of April differ not at all from the first days of the month with respect to business in machine tools, which continues on the same high level that has marked the first three months of this year, and the belief generally prevails that there will be no let-up in demand at least before July. No improvement in deliveries is noted, and local representatives of the leading tool building plants express themselves as doubtful of any while the present activity in the machine tool market continues. There are exceptions, of course, but factory orders calling for delivery under three or four months are the exception rather than the rule.

The trade is extremely optimistic with respect to continued good business during the present year. It is argued that so long as the present large output of automobiles, trucks and auto accessories continues at its present level the machine tool industry, in general, will be highly prosperous, and no forecast of reduced automotive production this year is hazarded by anyone who has been questioned on the subject. Inquiries for all types of tools are being received in good volume from industrialists located in midwestern states. No change is reported in the railroad buying situation, and no new lists have been received. Activity in used tools at high prices shows no indication of recession.

SOUTHERN DISTRICT

An upward trend has been noted in machinery and machine tool sales in the Southeast the past two weeks, with the present volume of business reported by most dealers better than at any time this season, and comparing favorably with the corresponding period of last year. Inquiries are also sufficiently heavy to indicate that business will hold up on an active basis through the late spring and early summer months, and that some lines will be unusually good.

The heaviest demand recently has come from the textile mill field, and the large number of new plants that are now being erected in Georgia, Alabama, Tennessee and the Carolinas has resulted in a call for new equipment that is said by many dealers to be the heaviest in some years, with prospects very promising.

Orders are being placed on a better basis for road machinery and equipment, and contractors' equipment is also moving well. This business, however, has not yet reached as heavy a basis as at this time last season due to the unusual amount of rainfall experienced in the Southeast this year that has retarded construction of all kinds. Inquiry is good and outlook for spring and summer excellent.

Railroads are placing more orders for heavier equipment for new shop projects, but not buying on as large a basis as usual at this period. The outlook is for a less than normal business.

Smaller machine shops and service stations continue to buy on a hard-to-mouth basis only, and are placing few orders for other than used or rebuilt tools and machinery.

DETROIT

There has been little or no change either in the volume or in the nature of sales in the machinery field during the past few weeks. The volume is still remarkably high and deliveries in a great many cases are many months behind orders.

For the past two months or more the real problem with dealers here has been to get deliveries. Inquiries are still continuing to come in and there is no apparent slackening in the general industrial development here. One outstanding firm here reports that it is six to nine months behind on almost all types of equipment and is getting more inquiries from automobile and accessory manufacturers than at any time within the past few years. This is not true throughout the entire trade here of course but it is more or less representative of the conditions.

All automobile manufacturers in the Detroit area are working at top speed and all of the body builders, accessory manufacturers and small tool and die shops are maintaining schedules that are higher than at any time in their history.

A number of the high-grade tool shops are making big expansions and most of the others are increasing their production schedules.

Most other Michigan industries are prospering and some machinery and equipment is being sold in the paper industry, the furniture field, farm machinery, electrical refrigeration plants and others. Foundries throughout the state are prosperous and many of them are making expansions, largely due to the work they get from the automotive industry.

In the automotive field the increasing trend is toward more and more highly productive machinery and machinery engineers are being required to exert themselves in the direction of devising improved types.

Employment in the Detroit area and throughout all of Michigan is higher than it has ever been before. There are more than 450,000 men employed in Detroit, according to the best available eslimates, or about 70,000 more than at this time last year. Most other industrial cities of the state are in a similar situation and overtime employment is more widespread than it has ever been.

CANADA

Business is still very good in the machinery and machine tool industry in Canada. Railroad buying of equipment and rolling stock continues to be the chief factor in the improved condition of the market, but demand for automobile parts, road-building machinery and mining machinery and equipment is also quite brisk. The latter field is especially promising as it is generally agreed that during the coming summer there will be unprecedented activity in the mining industry in all sections of the Dominion.

The structural steel market is quite active. Present demand is vigorous and prospects for the coming months are very promising. Operations in the different plants of Canada Foundries and Forgings, Ltd., are proceeding at a high rate of capacity and indications are that this condition is likely to continue for some time. Output from the company's plants in the first three months of the current year is stated to be considerably in excess of that in the corresponding period in 1928. The Waterloo Manufacturing Co., which is now making a specialty of manufacturing parts for machines, also reports good business. Sales so far this year are well ahead of last season. Orders have been placed recently by the Canada Creosoting Co., Ltd., for a considerable quantity of new machinery for the big plant at Edmonton, Alberta.

Automobile production in March reached a new record at 40,621 cars. This output was 20 per cent above the previous high level, established last May at 33,942 cars, and 30 per cent over the total of 31,287 cars made in February of this year. Much activity is promised for the Canadian plant of the Ford Motor Co., with the announcement of a transfer of orders for 1,000 automobiles from the parent concern to the Canadian plant. The cars to be manufactured at Windsor are for direct shipment to foreign countries.

CINCINNATI

A continued heavy demand in the past week is reported by the great majority of the machine tool manufacturers in the Cincinnati district. A small number report a slight loss in volume, but this was more than offset by increases had by others, and taking the trade as a whole a gain was made in the period, comparing it to the previous week. A concise statement made by one manufacturer sums up the situation in a general way, this being that "business is good and it is growing still better."

Local selling agents report that in the week they had a good volume of sales—in some cases slightly better than in the previous week. The market is livening up in local and adjacent territory, it is stated, and the prospects are bright for an increased demand.

The great majority of the orders booked during the week called for single tools and replacements and the great majority of the buyers were general machinists and miscellaneous users. The orders were well diversified as to sizes and types of requirements and were well scattered over the country. An order received from C. & O. Railroad, it is reported, called for several tools, and smaller purchases were made by other transportation companies. A few scattering orders came from the automotive field.

A large number of inquiries were received in the week, the great majority of these being from miscellaneous users, located in all sections of the country. Several lists of requirements were received from railroads, including the B. & O., the C. & O. and the Santa Fe, and because of these there is a feeling that this market is about to open up in a larger way.

Production was at a high level during the week in practically all plants. Manufacturing conditions were favorable in every way, but skilled labor is still scarce.

NEW ENGLAND

Machine tool sales continue steady at a level comparable with that of the past two or three weeks, little or no change being registered in that period. April, however, will be another good month in view of the continued brisk buying, and a higher production volume in most plants which are now showing gratifying improvement. Prices are firm with recent advances well maintained. The New England situation from the standpoint of all industries is particularly healthy and well balanced.

In this respect the pick-up in the shoe, paper and textile industries has done much to bring this about. Textile machinery builders in Worcester report a better first quarter this year than last and are looking forward to a good year. Grinding ma-

chinery builders in that section report the demand at a high level, and are shipping to all sections of the country. The foreign demand is also good.

New England buying and distribution of machinery, which is representative of 25 per cent of the whole industry, is definitely illustrative of a preferred demand for machines that produce at high speed. Manufacturers are looking more and more for this improved type of equipment, regardless of cost, that will turn out the greatest number of pieces per man hour. With the labor situation as strained as it is today, automatic machinery saving extra man power, becomes a necessity.

NEW YORK

Conditions in the machine tool market in the Metropolitan district remain unchanged, and there has been no perceptable let-up in the volume of sales made by local dealers and factory representatives, or in the number of inquiries received from various metal-working shops. While the sale of single machines is making up the bulk of the buying, here and there some large orders stand out. The large amount of equipment bought by the Eclipse Machine Co. last fortnight is an example, and during the past week one firm received three orders for lathes, averaging four machines apiece. Optimism prevails everywhere, and no one looks to a recession in business for some months to come.

Hopes for an increase in business from the railroads are on the ascendant, now that the large list of 37 machines by the Delaware & Lackawanna is out and other roads have or are about to follow suit with similar lists, though not so large as the first mentioned.

The price trend of machines continues upward, and further definite announcements are expected during the current week. One concern, however, has actually dropped prices considerably in order to out-sell competitive equipment.

Sales made by one dealer, the Triplex Machine Tool Co., during the week are indicative of present activity: One Swiss jig borer, a 6-spindle Edlund drill, a Stevens turret lathe, two Campbell nibblers, and a 4-ft. Fosdick radial drill.

General Electric Orders High for Quarter

Orders received by the General Electric Co. for the first quarter of 1929 amounted to $101,365,208, compared with $79,925,840 for the corresponding three months of last year, representing an increase of 27 per cent.

Management Congress to Be Held in Paris

The fourth International Scientific Management Congress is to be held in Paris in June, 1929, under arrangement of the International Committee for Scientific Management in collaboration with the International Management Institute. Full information concerning the congress may be obtained from the National Management Committee of France, 44 Rue de Rennes, Paris VIe, France.

Machinery and Supply Groups to Meet

Another joint meeting of the American Supply and Machinery Manufacturers' Association, the National Supply and Distributers' Association and the Southern Supply and Machinery Dealers' Association is to be held, May 7-9, at the Ambassador Hotel, Atlantic City, N. J. An attempt was made last year to form a single association of the three groups, but failed because of an adverse vote of the National Dealers' Association.

Business Items

The Eclipse Interchangeable Counterbore Co., Detroit, has just broken ground for a 2-story addition to its factory at 7410 St. Aubin Ave. The addition will be 64x115 ft., and the present offices of the company will be removed from the first floor of the present factory to the second floor of the addition, releasing all present office space to manufacturing. The ground floor of the addition will also be used entirely for machine shop work. Although manufacturing facilities were increased by 40 per cent about two years ago, the present facilities are already overcrowded, and it is expected that the new addition will permit further increase of about 75 per cent. It is expected that the new space will be available for occupancy before June 1.

The Borg Warner Corporation has completed negotations to acquire a large interest in the Morse Chain Co. and will exchange its stock for the stock of the latter company. The Morse firm has over $8,000,000 in assets and conducts an extensive business in the manufacture of power transmission chains and gearing for industrial purposes. The company also has an aircraft, adding machine, typewriter and electric clock division which are not being acquired by Borg Warner. In the consolidation Borg Warner will take over the plant at Ithaca with 405,000 sq.ft. of floor space and also the Detroit plant of 115,000 sq.ft. of floor space. The Morse Chain Co., Ltd., of England, and properties formerly owned by the Ithaca Street Railway Co. will also be acquired.

Toledo Precision Devices, Inc., has been formed as a branch of the Toledo Scale Co., Toledo, Ohio, to service manufacturing concerns facing special inspection problems. Special instruments and machines for checking both quantity and quality will be made by the new company, including machines used to sort connecting rods and to find their center of mass, to check the expansion of piston rings, and to measure scales. Officers of the new company are: H. D. Bennett, president; C. O. Marshall, vice-president and general manager; Carl Zinke, secretary; and M. L. Schutzberg, treasurer. The new factory will be of ultra-modern architecture.

Former officers of the Lynch Glass Machine Co. of Anderson were re-elected and reports made showing growth in the business of the company at the annual meeting of stockholders recently. The company was reorganized several months ago, and at that time the interests of J. W. Lynch were acquired. Business has grown materially during the last year, with an increase in net profits shown. Foreign business of the company has expanded considerably. Directors declared a second quarterly dividend of 50 cents a share payable May 15. The company now has 85,000 shares of common stock of no-par value.

A delegation from the Putilov Machine Works at Leningrad, headed by V. F. Grachev, manager of the plant, has returned to Russia after spending several months in this country purchasing equipment for the tractor division of the plant. The orders placed with various American firms have aggregated $750,000, and additional orders are now being placed. The new machinery ordered for the plant will make it possible to increase the annual production from 2,000 to 10,000 tractors.

The Brown Instrument Co., Philadelphia, Pa., is increasing its floor space 50 per cent by the addition of a central wing of two stories and by replacing a one-story wing with a two-story and basement building. About $200,000 will be spent on the improvements. This project is the fourth addition the Brown company has made to its plant in eight years.

The American Metallurgical Corporation, Boston, Mass., has changed its corporate name to the American Electric Furnace Co. The personnel of the organization and its business policies remain unchanged. Kristian A. Juthe is president; S. N. Juthe, vice-president; Albert J. Hanson, chief engineer; and J C. Juthe, sales manager.

Machinery and equipment of the Howlett Co., Moline, Ill., have been purchased by the Andrews & Olds Boiler and Welding Co., Moline, which on May I will move to the Howlett plant, where facilities will be available for expansion of its steel plate construction, boiler, tanks, smoke stacks and breechings lines.

Cutler-Hammer, Inc., of Milwaukee, Wis., has established a warehouse at Cleveland, to serve the east-central states. A complete line of standard motor control equipment and wiring devices will be available for immediate shipment. Sales offices for the district are located in Cleveland, Cincinnati, Buffalo and Pittsburgh.

The Moto Meter Gauge & Equipment Corporation has been organized under Delaware laws to effect the consolidation of the Moto Meter Co., Inc., and the Safe-T-Stat Co. The new company will manufacture complete panel equipment for automotive, marine and aeronautical uses.

The Peoria Drill and Seeder Co., Peoria, Ill., manufacturing standard farm equipment, has been acquired by the Vulcan Plow Co., Evansville, Ind. The new owners will continue operation of the plant, planning enlargement of its force and increase in production. The

Vulcan concern in recent months has acquired a number of Midwestern agricultural implement companies and will eventually merge them in one large corporation, with products covering the entire range of agricultural and power implements.. C. A. Pattison and L. E. Robey, who have been operating the Peoria plant for the last 23 years, will continue with the organization under the new owners.

The Allen-Bradley Co., Milwaukee, Wis., manufacturer of electric controlling apparatus, announces the establishment of a district office in Atlanta, at 101 Marietta St. H. Douglas Stier and G. G. Moore will be in charge of the Southern office.

The McDonald Machine Co., Chicago, manufacturer of can-making machinery has been acquired by the Continental Can Co., thus giving the Continental firm a complete line of units for manufacturing can-making machinery.

The Die, Tool, Special Machinery & Manufacturers Association has changed its name to the National Die & Special Tool Builders Association. Its offices are at 40 N. Wells St., Chicago, and George R. Tuthill is secretary.

The plant of the Maring Wire Co., Anderson, Ind., manufacturer of copper wire used by General Motors plants, has been sold to the Anaconda Copper & Cable Corporation and extensive improvements are planned.

The Strelinger Co., Detroit, dealer in machine tools, has contracted with the Sidney Machine Tool Co., Sidney, Ohio, to handle its line of lathes.

The Philadelphia Gear Works has opened a branch office at the Farmers Bank Bldg., Pittsburgh, Pa.

The Texas Gulf Sulphur Co., Inc., has removed its purchasing department to Newgulf, Wharton County, Texas.

Personals

ROBERT D. BLACK, advertising manager, and W. A. ROWE, production manager of the Black & Decker Manufacturing Co., Towson, Md., have just returned from Europe, where they spent several months at the factory of Black & Decker, Ltd., Bucks, England, and in visiting European markets. They also attended the Leipzig Fair where the company had an exhibit of its portable electric tools.

S. S. RAND, formerly associated with the Peck, Stow & Wilcox Co., Southington, Conn., and Cleveland is now vice-president and director of sales of the McCaffery File Corporation, Philadelphia, succeeding the late Frank Gould.

J. R. SHAYS, JR., of New York, has resigned as Eastern district representative for the Foote Bros. Gear & Machine Co., of Chicago, after sixteen years with the concern, and has formed his own firm, known as J. R. Shays, Jr., Inc., specializing in photographs of machinery and machinery installations for reproduction purposes. His office is located at 100 Greenwich St., New York.

JOHN MCC. PRICE has been appointed district manager in charge of the Chicago office of the Allen-Bradley Co., of Milwaukee, Wis. He was former district manager for the Industrial Controller Co. in the same territory. The Chicago office is located at 500 N. Dearborn Street.

C. O. MINIGER, president of the Electric Auto-Lite Co., has been elected chairman of the board of the U. S. L. Battery Corporation of Niagara Falls, N. Y. Daniel H. Kelly, vice-president of Auto-Lite, has been elected president of U.S.L. Battery.

A. M. LINDSLEY, formerly with the Stokes & Smith Co., is now production engineer with the Metallurgical Laboratories, Inc., Philadelphia, Pa., specialists in the heat-treatment of metals, with particular reference to aircraft work.

A. F. WHITE has been appointed general superintendent of the Donora (Pa.) steel works of the American Steel & Wire Co. in place of J. B. Clark retired. Mr. White was formerly assistant superintendent and is succeeded by W. F. Conklin.

R. C. PIERCE, consulting engineer and formerly Captain in the U. S. Army Air Service, is being retained by the Sikorsky Aviation Corporation, College Point, L. I., to handle research and mechanical development.

POWELL CROSLEY, JR. president of the Crosley Radio Corporation, Cincinnati, announces plans to build airplanes on a commercial basis. A new company is to be formed independent of the radio company.

L. S. KURTZ, superintendent of the final assembly plant of the Buick Motor Car Co., Detroit, has been made factory superintendent in place of Coleman Ross. Mr. Kurtz is succeeded by L. M. Taylor.

EX-PRESIDENT CALVIN COOLIDGE has been elected a Councillor of the National Industrial Conference Board.

Obituaries

EDWARD CARL STEARNS, 72, president of the E. C. Stearns Co., Syracuse, N. Y., at one time the world's largest maker of bicycles, died in that city on April 21. At the height of the bicycle industry he had four plants going in Syracuse employing 3,500 persons, with another plant in Toronto and one in Germany. In 1898 he sold the business to the American Cycle Co. The present company has been making hardware and small tools, including lawn mowers and other machines, some of which Mr. Stearns invented.

EDWARD FRANCIS CARRY, 62, president of the Pullman Co., died on April 24 at Chicago. He was secretary of the Wells & French Co. until 1899 and then joined the American Foundry Co., advancing to the position of first vice-president and manager in 1915. In 1916 he became president of the Haskell & Barker Car Co., Inc., and remained with that company until 1922 when he became president of the Pullman Co. During the World War he was director of operations of the Federal Shipping Board, and in 1928 he was appointed chairman of a port, terminal and harbor improvement commission of Chicago.

Forthcoming Meetings

AMERICAN MANAGEMENT ASSOCIATION. Annual meeting, Hotel Pennsylvania, New York, May 7. W. J. Donald, managing director, 20 Vesey St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Eastern Spring meeting, Rochester, N. Y., week of May 13. Third national meeting of the aeronautic division, St. Louis, Mo., May 27-30. Semi-annual meeting, Salt Lake City, Utah, July 1-4. Third national meeting of the Iron and Steel Division, during the Steel Treaters' Exposition, Cleveland, September 11-13. Calvin W. Rice, secretary, 29 West 39th St., New York City.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION. Thirteenth annual meeting to be held in the Hotel Statler, Cleveland, Ohio, May 16-18. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland.

NATIONAL ASSOCIATION OF PURCHASING AGENTS. Annual meeting, June 3-6, at Buffalo. G. A. Renard, secretary, 11 Park Place, New York.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, June 24-28, at the Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

SOCIETY OF AUTOMOTIVE ENGINEERS. Summer meeting, Saranac Inn, Upper Saranac Lake, N. Y., June 25-28. Coker F. Clarkson, manager, 29 E. 39th St., New York.

NATIONAL METAL CONGRESS. To be held in Cleveland September 9 to 13. Simultaneous meetings of the American Welding Society; the Institute of Mining & Metallurgical Engineers; the Iron & Steel Division, American Society of Mechanical Engineers; the Iron & Steel Division, A.I.M.E.; and the American Society for Steel Treating.

MACHINE TOOL BUILDERS EXPOSITION. Under the auspices of the National Machine Tool Builders Association, Sept. 30 to Oct. 4, in the Public Auditorium, Cleveland, Ohio. Ernest F. DuBrul, general manager, 826 Provident Bank Bldg., Cincinnati.

The Weekly Price Guide

Rise and Fall of the Market

PRICE reductions appear this week in non-ferrous metals, while steel holds firmly to quoted levels. Electrolytic copper is down 1c. per lb., to 21⅜c., at New York warehouses. Tin is off 2c. per lb., to 49c. The decline in raw metals has exerted downward pressure on fabricated brass and copper, solder and scrap, in the principal buying centers. Maximum on furnace coke at Carnellsville, is down 5c. per ton, to $2.85. There is active demand at present for bolts, nuts, rivets, hot-rolled strip and cold finished material. Prices remain steady in these items. Semi-finished steel continues scarce. No scarcity, however, has developed in pig iron.

(All prices as of Apr. 26, 1929)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$18.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 1.75@2.25)	24.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	15.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.76)	21.76
Virginia No. 2	27.17
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	21.26
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.20	3.35	3.25	3.90*
No. 12	2.25	3.40	3.30	3.95*
No. 14	2.35	3.45	3.35	4.00*
No. 16	2.45	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.75	3.60	3.50	3.80
No. 22	2.90	3.75	3.65	3.95
No. 24	2.95	3.80	3.70	4.00
No. 26	3.05	3.90	3.80	4.10
No. 28	3.20	4.50	3.95	4.25
Galvanized				
No. 10	2.90	3.95	3.85	4.05
Nos. 12 to 14	3.00	4.05	3.95	4.15
No. 16	3.10	4.15	4.05	4.25
No. 18	3.25	4.30	4.20	4.40
No. 20	3.40	4.45	4.40	4.55
No. 22	3.45	4.50	4.45	4.60
No. 24	3.70	4.65	4.55	4.75
No. 26	3.85	4.90	4.80	5.00
No. 28	4.10	5.15	5.05	5.25

*Up to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	—Diameter in Inches— External	Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

— Thickness — B.w.g. and Decimal Fractions		Outside Diameter in Inches — Price per Foot ⅛	¼	⅜	½	1	1¼	1½
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.50	3.65	3.60
Cold drawn, flat or square‡	4.00	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	3.75†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, 5/16-in. thick. †Up to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			21.75
Tin, Straits, pigs, New York			49.00
Lead, pigs, E. St. Louis	6.85	New York	8.50
Zinc, slabs, E. St. Louis	6.80	New York	8.50

	New York	Cleveland	Chicago
Antimony, slabs	12.50	13.50	14.25
Copper sheets, base	33.75	27.75	27.75
Copper wire, base	29.37½	20.25	19.87½*
Copper bars, base	32.25	26.25	26.25
Copper tubing, base	35.12½	29.25	29.25
Brass sheets, high, base	27.12½	23.25	23.25
Brass tubing, high, base	32.00	28.25	28.25
Brass rods, high, base	24.87½	21.25	21.25
Brass wire, high, base	27.62½	23.75	23.75

*At mill.

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25.00*	24.30	24.30
Zinc sheets (casks).....	10.50@11.00	11.70	10.11
Solder (½ and ½).....	35.00	31.75	31@34
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade.....			70.00
Commercial genuine, intermediate grade.....			54.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt.....			12.75

*Delivered.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished.....	52.00	42.00
Sheets, cold rolled.....	60.00	50.00
Strip, cold rolled.....	55.00	45.00
Rods, hot rolled.....	45.00	35.00
Rods, cold rolled.....	53.00	40.00†
Tubing.....	75.00*	90.00
Angles, hot rolled.....	50.00	40.00
Plates.....	52.00	42.00

*Seamless. †Cold drawn.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity offered for sale:

	New York	Cleveland	Chicago
Crucible copper.....	14.50 @15.00	13.50	13.00 @14.00
Copper, heavy, and wire..	13.50 @14.50	13.00	12.00 @13.00
Copper, light, and bottoms	11.75 @12.25	12.50	11.00 @12.00
Heavy lead.....	5.25 @ 5.50	6.25	5.00 @ 5.50
Tea lead.....	3.75 @ 4.25	4.25	4.00 @ 4.50
Brass, heavy, yellow.....	8.00 @ 8.50	8.00	8.00 @ 8.50
Brass, heavy, red.....	.....	12.50	12.00 @12.50
Brass, light.....	6.75 @ 7.25	7.50	8.00 @ 8.50
No. 1 yellow rod turnings.	9.00 @ 9.50	9.00	10.00 @10.50
Zinc.....	3.25 @ 3.75	3.25	3.00 @ 3.25

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20.....	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20.....	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20.....	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.†	.16	38.00 per M	.16
Sal soda, per lb.....	.02½	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.109	.11	.113
Cutting oil, about 25% lard, in 5 gal. cans, per gal.....	.55	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal..	.33	.36	.35
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt...	30– 5%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60– 5%	50–10%

*All waste in bale lots. †100-lb. bales.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb..	$0.0325	$0.0325	$0.0325
Cold drawn shafting...	per lb..	.035	.035	.034
Brass rods.....	per lb..	.2487½	.2487½	.165
Solder (½ and ½).....	per lb..	.35	.3525	.335
Cotton waste, white...	per lb..	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.....	per 100.	3.60	3.60	3.10
Lard cutting oil.....	per gal.	.55	.55	.65
Machine oil.....	per gal.	.33	.33	.30
Belting, leather, medium.....	off list..	30–10%	30–10%	35%
Machine bolts, up to 1x30 in., full kegs...	off list..	50-10%*	50–10%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper.....	$4.50	$4.29	$4.29
Emery cloth.....	22.93	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper.....	2.64	2.04	2.04
Cloth.....	3.60	3.59	3.59
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville,		2.75@2.85
Coke, prompt foundry, per net ton...	Connellsville,		3.75@4.50
White lead, dry or in oil...	100 lb. kegs....	New York,	13.75
Red lead, dry.....	100 lb. kegs....	New York,	13.75
Red lead, in oil.....	100 lb. kegs....	New York,	15.25

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less.....	60%
Larger, up to 1 x 30-in., full kegs, list less.....	50–10%
Less than full kegs or case lots, add to list.....	10%
Fitting-up bolts: list less.....	45%
Lag screws:	
Up to ½-in. x 6-in., list less.....	60%
Larger, list less.....	50–10%
Less than full keg or case lots, add to list.....	10%
Rivets:	
Structural, round head, full kegs, net.....	$4.50
Structural, round head, broken kegs, net.....	6.00
Tank, 7–16-in. dia. and smaller, list less.....	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less.....	60%
Larger, up to 3-in., list less.....	40–10%
Less than keg or case lots, add to list.....	10%
Washers:	
Wrought, full kegs, per 100 lb., list less.....	$4.00
Wrought, broken kegs, per 100 lb., list less.....	2.00
Turnbuckles:	
With stub ends, list less.....	20%
Without stub ends, list less.....	50%
Chain:	
Proof coil, base, per 100 lb., net.....	$7.10
Cast iron welding flux, per lb., net.....	.40
Brazing flux, per lb., net.....	.80

Machine Requirements and Industrial Construction

Equipment Wanted

Mass., Boston—Acme Electric Heating Co., 1217 Washington St.—36 in squaring shear and tinsmith brake.

Mich., Detroit—Hudson Motor Car Co., Gratiot Ave.—crane and conveying equipment for proposed 1 story, 93 x 320 ft. addition to factory on Gratiot Ave. Estimated cost $100,000.

Mich., Pontiac—Oakland Motor Car Co.—motor assembly equipment for proposed 1 story, 250 x 450 ft. addition to automobile factory. Estimated cost $300,000.

N. Y., Syracuse—Bd. of Contract and Supply—will receive bids until May 6 for machinery and equipment for machine, science and electrical shops for Porter and Bellevue School additions.

O., Cleveland—Cleveland Union Terminal Co., Terminal Tower, H. D. Jouett, Ch. Engr.—wheel, axle and journal lathe, boring mill, radial drill, wheel grinder, planer, punch and shear, drill press, speed press and treading machine for new inspection shed and motor repair shops at Collinwood and Linndale yards.

O., Columbus—Ohio Motor Wheel Co., 44 East Broad St., W. A. Rubrecht, Treas. and Mgr.—machinery and equipment including lathe, drill press, grinder, etc.

Ore., Portland—Tice Lock Washer Co., F. Cornell, Pres. and Gen. Mgr., Stock Exchange Bldg.—machinery and equipment including power presses and dies, for recently acquired plant.

Pa., Pittsburgh—Bd. of Education, Administration Bldg., Bellefield Ave.—will receive bids until May 15 for power hack saw for Allegheny high school.

Ont., Stratford—Wallace Aircraft Co., Rockford, Ill.—assembly equipment for proposed airplane factory here.

Ont., London—C. E. Marley Ltd., 268 York St.—machinery and equipment for the manufacture of road signs, etc. to replace fire loss. $25,000.

Ont., Welland—Welland Steel Castings Ltd., Victoria Ave.—motors, furnaces and equipment for plant to replace fire loss. $15,000.

Opportunities for Future Business

Ala., Birmingham — Virginia Bridge & Iron Co., C. E. Michael, Pres., 3900 8th Ave. N., plans the construction of a new steel fabricating plant. Estimated cost $2,000,000.

Calif., Eureka — State Highway Dept., Sacramento, awarded contract for the construction of division maintenance shops and offices. Estimated cost $72,372.

Calif., Long Beach — Modern Furniture Co., 733 Aliso St., Los Angeles, is having plans prepared for a 3 story, 160 x 250 ft. factory on Ellis St. R. D. Van Alstine, Heartwell Bldg., Long Beach, Archt.

Calif., Los Angeles—A. I. Rouda, Lissner Bldg., awarded contract for a 6 story, 60 x 140 ft. garage on South Hobart Blvd. Estimated cost $250,000.

Conn., Bloomfield—School Board, will soon award contract for a 2 story, 114 x 150 ft. school including manual training shops, etc. on Park Ave. Estimated cost $125,000 to $150,000. W. P. Crabtree & Son, 410 Asylum St., Hartford, Archts.

Conn., Bridgeport—Bridgeport Hardware Mfg. Co., A. E. Keating, 461 Iraniston Ave., awarded contract for a 1 story, 100 x 100 ft., factory. Estimated cost $42,000. Noted Jan. 24.

Conn., Bridgeport — Crane Co., South Ave., awarded contract for a 1 and 3 story, 125 x 500 and 40 x 45 ft. plant for the manufacture of household radiators. Estimated cost $300,000.

Conn., Elmwood — Wiremold Co., 410 Asylum St., Hartford, is having plans prepared for a 2 story, 98 x 200 ft. factory. Estimated cost $175,000. Greenwood & Noerr, 525 Main St., Archts.

Conn., Hartford — L. & H. Motor Co., T. W. Campbell, 90 High St., plans a 3 story, 100 x 300 ft. factory at Broad, Howard and Flower Sts. Estimated cost $350,000.

Ill., Chicago — Evans Flexible Reamer Co., 3513 Lincoln Ave., is having sketches made for a 3 story, 75 x 100 ft. machine shop at 3711 North Clark St. Estimated cost $40,000. Architect not selected.

Ill., Cicero—Empire Metal Products Co., W. R. Pounder, Pres., plans to remodel and equip plant at 5443 Roosevelt Rd., recently acquired.

Ill., East St. Louis—Mobile & Ohio R.R., St. Louis, Mo., awarded contract for the construction of a round house and shops, here. Estimated cost $400,000. Noted Jan. 31.

Ill., Quincy—Otis Elevator Co., 11th Ave. and 26th St., New York, N. Y., awarded contract for the construction of a foundry storage building, etc. here. Estimated cost $250,000. Noted Mar. 28.

Ind., Alexandria—Aladdin Lamp Works, awarded contract for the construction of two factory buildings. Estimated cost $150,000.

Ind., Alexandria—Banner Rock Products Co., Div. of Johns-Manville Co., Madison Ave. and 41st St., New York, N. Y., had plans prepared for two 3 story, 54 x 192 and 120 x 160 ft. factory on West Washington St. Estimated cost $110,000.

Ind., Indianapolis—Marmon Motor Co., 1101 West Morris St., is receiving bids for the construction of a factory at West Morris St. Estimated cost $50,000. Private plans.

Ia., Des Moines—Globe Machinery & Supply Co., F. W. Swanson, Pres., 205-211 Court Ave., awarded contract for addition to plant. Estimated cost $100,000.

Kan., Wichita—Cissna Aircraft Co., First and Glenn Sts., awarded contract for the construction of an aircraft factory, five units, two 1 story, 75 x 180 and three 1 story, 75 x 100 ft. Estimated cost $100,000.

Md., Baltimore—E. Katzinger Co., 1949 North Cicero Ave., Chicago, Ill., manufacture of bakers' utensils tools and machinery, will soon receive bids on revised plans for a 2 story, 143 x 180 ft. factory at East Ave. and 8th and 9th Sts. Estimated cost $500,000. Lockwood, Greene & Co., Wrigley Bldg., Chicago, Ill., Engrs. Noted Feb. 7.

Mich., Albion—Decker Screw Products Co., awarded contract for a 1 story, 55 x 195 ft. factory and machine shop on Clark St. Estimated cost $45,000.

Mich., Bay City—Bay City Shovels, Inc., plans the construction of a factory for assembly of power shovels and cranes.

Mich., Detroit—Murray Corp. of America, 1424 Aberle Rd., plans extensions to automobile body plant.

Mich., Detroit — Richards Bros. Die Works, 4646 Lawton Ave., plans addition to plant. Estimated cost $90,000.

Mich., Monroe—Newton Steel Co., First National Bank Bldg., Youngstown, O., awarded contract for a 1 story, 300 x 1,500 ft. steel mill here.

Miss., Greenville—Chicago Mill & Lumber Co., 111 West Washington St., Chicago, Ill., will build an insulating board mill here. Estimated cost $1,000,000.

N. Y., Long Island City—J. & S. Paynier, 835 Humbold St., Brooklyn, plans a 2 story, 75 x 180 ft. smelting plant and foundry at Borden Ave. and Haywood St. Estimated cost $40,000. J. M. Klein, 65 Court St., Archt.

O., Cincinnati — Crosley Radio Corp., Colerain Ave., awarded contract for an 8 story factory. Estimated cost $500,000. Noted Apr. 25.

O., Cleveland—Cleveland Heater Co., L. Friedman, Pres., 1900 West 112th St., will soon award contract for a 1 story, 100 x 144 ft. addition to factory. Estimated cost $50,000. G. S. Rider Co., Century Bldg., Archt.

O., Listowel —Malcolm Furniture Co., Main St., plans a 3 story addition to factory. Estimated cost $75,000.

O., Massillon—Massillon Rivet & Mfg. Co., plans the construction of a 1 story, 38 x 100 ft. factory on Erie St. S. Estimated cost $40,000. Private plans.

O., Toledo—City Auto Stamping Co., c/o Langdon, Hohly & Gram Security Bank Bldg., Archts., awarded contract for a 1 story, 240 x 300 ft. factory. Estimated cost $250,000.

O., Toledo — Toledo Scale Co., W. C. Gookin, V. Pres., 216 Monroe St., will soon award contract for the construction of a plant. Estimated cost $500,000.

Ore., Springfield — Williamette Valley Veneer Co., J. A. McPherson, Pres., Portland, recently incorporated, plans the construction of a veneer mill here.

Pa., Butler—American Rolling Mills Co., Middletown, O., awarded contract for a 1 story addition to strip mill here. Estimated cost $50,000. Dwight P. Robinson Co., 125 East 46th St., New York, N. Y., Engr.

Pa., Homestead—Standard Propeller Co., is having plans prepared for a 3 story, 130 x 240 ft. plant. Estimated cost $250,000. A. G. Wickerham, 135 East 8th Ave., Archt.

Pa., Pittsburgh — Heppenstall Knife & Forge Co., 4620 Hatfield St., is receiving bids for two factory buildings, 60 x 100 and 20 x 120 ft. each 1 story. Estimated cost $40,000.

Pa., Pittsburgh—Steel City Electric Co., 1207 Columbus Ave., awarded contract for a 2 story, 40 x 144 ft. addition to factory on Columbus Ave. Estimated cost $40,000.

Pa., Washington—Washington Mold Machinery & Foundry Co., is receiving bids for a 1, 2 and 3 story foundry on West Beau St. Estimated cost $60,000. F. Kubitz, Publication Bldg., Pittsburgh, Archt. Noted Apr. 25.

Pa., York—U. S. Chain & Forging Co., awarded contract for a 1 story addition to plant. Estimated cost $40,000.

Tenn., Knoxville—Chevrolet Motor Co., J. E. Johnson, Mgr., 421 North Gay St., will soon award contract for a 3 story, 160 x 180 ft. assembly and storage plant. Estimated cost $200,000. A. Kahn, Inc., Marquette Bldg., Detroit, Mich., Archt.

Tex., Beaumont—Kansas City Southern Ry. Co., Kansas City, plans extensions and improvements to yards including roundhouse, machine shop, etc. here. Estimated cost $1,000,000. A. N. Reece, is chief engineer.

Tex., Beaumont—F. W. Krieter Battery Co., plans the construction of an electric battery factory at Main and Mulberry Sts. Estimated cost $40,000. Private plans.

W. Va., Wierton—Wierton Steel Co., awarded contract for a 1 story, 100 x 625 ft. addition to mill. Estimated cost $150,000.

B. C., Albert Bay—British Columbia Fishing & Packing Co. Ltd., 410 Seymour St. manufacturers of boxes, shooks, baskets and crates, plans addition to plant here.

N. S., Liverpool—Southern Salvage Co., manufacturers of buckets, plans the construction of a factory. Estimated cost $75,000.

Ont., St. Thomas—Canada Wood Products Co., plans the construction of a new plant.